PUBLIC HEALTH REPORTS

In this issue

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frontispiece

Woman of the Fort Apache Reservation in Arizona obtains her domestic water from a stream. See article on construction of sanitary facilities for Indians and Alaska natives on pp. 317–322.

PHR

SYNOPSES

SCHNURRENBERGER, PAUL R. (Ohio Department of Health), and RUSSELL, JACK H.: ***A rabies control program in Ohio. Public Health Reports, Vol. 76, April 1961, pp. 281–286.***

Economic factors, undiagnosed illnesses of animals, and their relatively short lifespan hamper efforts to gather vital statistics on the zoonoses. Rabies, at least in most animals, is the classic exception to this.

Enzootic rabies in a southern Ohio area accounted for 65 percent of the State's reported cases of canine rabies for a 3-year period. Hundreds of persons received antirabies treatment, but little was done to eliminate the reservoir of the disease.

Control programs were conducted between April 1957 and May 1958 in Lawrence, Jackson, and Scioto Counties. To combat public apathy, the cost of treatment as well as the threat to public health was stressed. Programs in the schools alerted children and their families to the situation and publicized vaccination clinics for unlicensed dogs.

At the clinics, held wherever there were population concentrations, pets were immunized for a $1 fee at the rate of 100 per hour. In Lawrence County more than 6,000 animals were immunized, although the county had issued less than half that number of dog licenses the previous year.

Only two cases of canine rabies have occurred in the three counties since the control programs ended, and, in Ohio, the species distribution of rabies has been drastically altered. Major emphasis in control in the State is being shifted from the canine to the wildlife population.

BOGAN, R. H. (University of Washington, Seattle): ***Removal of sewage nutrients by algae. Public Health Reports, Vol. 76, April 1961, pp. 301–308.***

To cope with the growing challenge of water pollution by nutrient-rich wastes, excessive growth of phytoplankton may be controlled by diverting wastes into other receiving waters or by treating the wastes to remove growth-promoting substances. Phosphorus recovery appears to be an effective and practical means of controlling aquatic growths, but an economically feasible process awaits development.

In an experimental inquiry into the usefulness of algae for recovering phosphorus from sewage, a high-rate process was developed in the laboratory whereby soluble phosphorus reductions equivalent to 90 percent or more were achieved with contact times as brief as 6 to 12 hours. Subsequent studies in the field on a larger scale showed the effectiveness of the process to be related to available light intensity. Photosynthetic adjustment of pH permitted rapid removal of phosphorus through coagulation and sedimentation. Repeated use of algal cell tissue in conjunction with high photosynthetic pH levels greatly enhanced the recovery of algae by sedimentation.

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SYNOPSES

ROTH, EARL E. (Louisiana State University), ADAMS, W. V., and LINDER, DONNA: ***Isolation of Leptospira canicola from skunks in Louisiana. Public Health Reports, Vol. 76, April 1961, pp. 335–340.***

Isolation of *Leptospira canicola* from five striped skunks, *Mephitis mephitis*, collected in Louisiana establishes a wildlife source of *L. canicola* in the United States that may infect both man and animals. All five strains were isolated by direct inoculation of solid mediums with 10 percent kidney suspension. All but one strain was obtained in pure culture by direct inoculation of five types of semisolid mediums with 10 percent kidney suspension. Employing the microscopic agglutination test and the agglutinin-absorption test, all five strains were shown to be homologous with *L. canicola*, Hond Utrecht.

Agglutination tests with serums of the five skunks revealed low but predominant serotiters for *L. canicola*. The serum from one skunk also agglutinated antigens of the *hebdomadis* serogroup.

DELGADO, GRACIELA, BRUMBACK, C. L., and DEAVER, MARY BRICE (Florida State Board of Health): ***Eating patterns among migrant families. Public Health Reports, Vol. 76, April 1961, pp. 349–355.***

A study of the diet patterns of a group of Negro migrant families living in a labor camp in Belle Glade, Fla., revealed a lack of certain groups of protective foods. It also pointed up the need for better use of the foods available and for a wiser selection of foods purchased in relation to the amount of money spent.

The most significant findings of the study were the following:

Low consumption of milk and milk products. However, due to the extensive use of self-rising flour, the calcium content of the diets was higher than expected. Riboflavin content of the diets was low.

Low consumption of green and yellow vegetables and low vitamin A content of the diets.

Low consumption of citrus and other fruits and low vitamin C content of the diets.

Greater consumption of proteins than of the above-mentioned groups of foods. However, the amounts of animal protein eaten by the larger families were too small to meet the dietary requirements for the family as a whole. Legumes were consumed in amounts above those recommended by the Food and Nutrition Board of the National Research Council. This raised the iron content of the diets.

Consumption of starches, fats, and sweets in excess of the recommended amounts. However, the calorie allowance in the diets of 80 percent of the families is low.

Impact of Public Health on Society

RUTH B. FREEMAN, R.N., Ed.D.

PUBLIC HEALTH action is at least as old as recorded history. Wherever men have lived together, they have set up regulations to govern their health practices. However, the modern public health movement—a broad-scale, concerted community action—is of more recent origin. It has grown out of the great social changes of the industrial revolution and out of the great political struggles that have brought more and more freedom and opportunity to the peoples of the world. Now public health is moving into a new era, an era of space, of discovery, of kaleidoscopic change. It is opportune to think again of our mission as public health workers and of the impact of our profession of public health on society today.

If you ask people what they think about this task in which we are engaged, their responses will vary all the way from "Public health does good," to "Really, the job of public health is over. We have licked communicable disease and our sanitation problems, and we need only a minimal maintenance service." Many of our professional statements are equally vague or limited in the concept of public health that they present to the public. Descriptions of programs tell what is to be done and what is done, but rarely is there any mention of why public health action is so essential. The objectives of public health are frequently not clear, and all too often they are stated in terms that are either vague or narrowly operational, "to provide maternal and child health supervision" or "to control tuberculosis," for example.

To the question, Why public health action? everyone comes up with a different answer. To me, the mission of public health is to bring to bear in a synthesized way all available scientific, educational, and social skills, knowledges, and discoveries so that they become operative promptly as agents for the betterment of individual, family, and community health. You will notice that this does not say the mission of the public health department or of public health workers, but rather of the total public health movement. The action to bring these forces to bear for social betterment may be taken by public health departments, voluntary agencies, private physicians, industry, or even individuals, their families, and their neighbors. Any or all of these may become part of general public health action. This is one of the unique aspects of our work, that it involves the community as a whole, just as it benefits the community as a whole.

The objective in public health is in some way to put to work for people what we have learned about the forces that motivate and activate groups, about tranquilizers, about the relation of oxygen therapy to retrolental fibroplasia, about the genetic factors that influence the drug resistance of certain organisms—all the diversified knowledge available. Some idea of the effect organized action may have on the lag between discovery and application is evident from a comparison of, for example, the time it took for the discoveries of Holmes and Semmelweiss to reduce the death rate of par-

Dr. Freeman is associate professor of public health administration at the Johns Hopkins University. *She delivered the address from which this article was taken before the Puerto Rico Public Health Association in San Juan, February 3, 1960, while she was a temporary staff member of the Rockefeller Foundation.*

turient mothers with the time it took to get the Salk vaccine from the laboratory into the arms of children.

What Is Public Health?

Looking further at this job of ours, it may be profitable to distinguish among public health, public health practice, and public health services. Public health, stated simply, may be conceived of as a state of well-being of the community, including the physical, mental, and social aspects of health. Basic to public health is the health of the individuals that make up the public. Our present-day concept of wellness, as contrasted to the concept of absence of disease, as a goal sets a standard of health both different from and broader than that of the past. We are seeking optimal adaptation to disability or disease as well as freedom from preventable disease or illness, freedom from disabling ways of thinking or behaving as well as freedom from poor posture or inadequate nutrition. Under this definition, personal isolation, for example, or distorted values that prevent people from functioning as happy individuals and social beings would become part of the health picture.

However, community health is more than the sum total of all individual health. In our country, the family is a focal social unit, and the health of the family is considered essential for our national well-being. If family members lack mutual support or are so tightly tied to one another that they are smothered by mutual overdependence, we may have healthy persons in a family which is not healthy. Community health is even broader in its implications than family health. In addition to healthy individuals and healthy families, the healthy community must also have the facilities, the group character, the kinds of interrelationships within the community as a whole that make it possible to maintain health. For example, healthy people living next to a polluted stream are living in an unhealthy community because there is a constant threat to health.

People in a community who have not learned to work together as neighbors will have trouble handling their community health problems effectively. The self-help housing program here in Puerto Rico, for example, is contributing to health not only by creating a better environment, but also by fostering neighborly interdependence and developing in the people an ability to work constructively together that should carry over to such problems as helping a neighbor recognize the need for medical care, or providing friendly supporting services needed by the long-term patient, or understanding the need for tax support for health services to reach all the people.

What we want, then, is a community in which responsible, knowledgeable individuals protect and conserve their own and their family's health and contribute to the maintenance of the health of their neighbors and of their community through action, through tax support, and through their own personal support and understanding.

When we look at this goal, it becomes apparent that public health practice must be more than the carrying out of a few preventive medical procedures. The job requires the application of multiple professional skills for community diagnosis and the application of medical, educational, social, or environmental therapy for maintaining health, for mobilizing the public, for assuring the necessary health action.

If this premise is accepted, it becomes obvious that public health cannot be the province of any one profession. Public health is not simply medical care in which different skills are needed, nor is it health education alone. Community diagnosis, one of the fundamental skills of public health, entails knowledge of the existence of disease and of the level of susceptibility to certain types of health problems. Susceptibility to tuberculosis, for instance, may be shown by the epidemiological characteristics of the disease; or to diphtheria, by the immunization status; or to juvenile delinquency, by predelinquent behavior or social disorganization. Community diagnosis requires, too, knowledge of the competence of the population in relation to its own health care, as well as the adequacy and extent of private medical care, the number and distribution of hospitals and diagnostic facilities, and how frequently they are used and by whom. The methods by which people communicate with one another, the ways in

which they take action on community problems, and the economic and social competence of the community are also essential components of the community's health. Only when the community is seen "in the round" in this way is it possible to plan effectively for the public health program the people need.

Public health services have been described in so many different ways that it would be impossible to present fairly all the points of view. To me, public health service is whatever health service the public decides can best be provided through organized rather than individual effort. Public health service is not limited to preventive care, since preventive care is an integral part of all medical practice, wherever it may be and under whatever auspices. There is no list of five or six or seven areas that are the only appropriate public health activities, and the size of a problem cannot be considered a legitimate criterion of its appropriateness for public health action.

While it is the public's responsibility to decide what it prefers to provide as a group, it is the responsibility of the public health profession to provide information pertaining to needs and ways of meeting them so that the public is able to make a wise decision. It is also the responsibility of the profession to control professional practice, for this is not a matter in which the public is competent. For example, it is a public responsibility to decide whether vaccination will be provided through community clinics supported from tax funds or primarily by individual medical practitioners. It is the responsibility of the professional group to see to it that the vaccination procedures are safe and properly tested, that those who administer the vaccine are qualified, and that the public is informed of the probable outcomes of the program that is undertaken.

Its Effects on Society

If we conceive of public health practice and services in this broad context, it is obvious that they will have a profound impact on the general welfare. If a man is cured of active tuberculosis so that he can maintain himself and his family, and if the family is kept intact while at the same time the community is protected from infection, the hazard of related illness or emotional stress is reduced, as is the likelihood of continuing indigence. This result represents a good investment. If we think of the plus factors that may be gained through high-quality public health services in tuberculosis, we may find that the family is strengthened, that teaching regarding general hygiene protects the family not only in relation to tuberculosis but in other ways as well, that through their experience with this disease they get a better understanding of how to use hospital and diagnostic facilities for other types of health care. The tuberculosis program addressed to the general public may not only inform people about tuberculosis and motivate them to obtain early diagnosis but may, in addition, teach them about the overall public health program and their part in promoting it.

Public health services may also have a definite impact on the values of people served. To the degree that a public health worker considers the patient as a person and shows a willingness to listen to and learn from him, and to the degree that the public health worker expects the patient to contribute to his own, his family's, and his community's help, public health services can serve to develop values that are consistent with our democratic way of life.

Public health may also have a decided impact on the education of the professional group that constitutes the public health team. Public health action requires the synthesis of efforts of many individuals and groups. This raises the question of how we can best teach professional workers to function in this integrated way. What requirements does this set up for orientation of professional workers to the activities of those in different fields of work? For joint learning? For relating and phasing of professional education in the several fields so that we have the personnel we need when we need them? For example, as the character of medical practice changes, new kinds of obligations may be placed on nurses, on physical therapists, on medical social workers, and on health educators. Unless basic and continuing education in these four related fields is adapted to developments in medicine, the products of professional schools in those fields will not be ready to work effectively with one another.

Public health services may also have a distinct impact on community social structure. Public health programs designed so neighbors can help neighbors produce social patterns that may carry over to other things. As people group together to build a house or dig a well or to take a class in baby care or first aid, they learn a way of doing things that may remain with them when the problem is one of civil defense or epidemic or a way that will make it easy to work together for a diagnostic clinic or a mass vaccination program.

The influence we exert as public health workers may be individual as well as professional. The way in which we do things ourselves, as well as what we do, may have an effect on those we serve.

The ways in which we act in concert with members of other professions through our public health associations and through our individual disciplines and their associations also have importance in strengthening the impact of public health services on society. Membership in an association may mean simply attending annual meetings and social events. Or it may mean becoming involved with the concerted thinking, decisions, and actions that are needed if the organization is to function as an important social force. Through the channels of our organizations we can do much not only to bring to the public the best possible health care but also to enlarge our own understanding and to use our personal as well as our professional skills to contribute more and more to the general welfare. In this way we extend our horizons and deepen our perceptions so that in the future our profession of public health can truly fulfill its bright promise.

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exhibits

Federal and State Radiological Health Goals

As part of its program of technical assistance to the States, the Division of Radiological Health, Public Health Service, designed this exhibit to show how Federal-State relationships can be strengthened and to stimulate continued growth of comprehensive radiological health programs.

The exhibit delineates the major objectives of Federal-State programs with respect to public exposure to ionizing radiations from all sources. It shows how these goals can be achieved through a concerted program of measurement, assessment, control, and reduction of public exposure. It lists the elements of a comprehensive radiological health program as recommended by the Association of State and Territorial Health Officers.

Specifications: A free-standing, 3-panel exhibit, 10 feet long, 7 feet high, and 2 feet deep; total weight approximately 380 pounds including a single packing crate. Lighting fixtures require one 600-watt outlet. Shelves are provided on each side panel for displaying literature.

The exhibit also points out graphically States which have a radiological health advisory group, those with enabling legislation, those requiring registration of radiation sources, and those which have radiation codes or regulations.

It is available for loan without charge, exclusive of shipping costs.

Further information, including arrangements for borrowing, can be obtained from the Division of Radiological Health, Public Health Service, U.S. Department of Health, Education, and Welfare, Washington 25, D.C.

A Rabies Control Program in Ohio

PAUL R. SCHNURRENBERGER, D.V.M., M.P.H., and JACK H. RUSSELL, D.V.M., M.P.H.

THE TASK of delineating human populations at risk of contracting a given disease is not too difficult provided adequate diagnostic tools and reporting procedures are available. The accurate vital statistics currently maintained by most official health agencies allow determination of morbidity and mortality rates with breakdowns by age, sex, race, residence, and other pertinent characteristics for the majority of our common diseases, both communicable and noncommunicable.

In domestic animals, however, an entirely different situation prevails. Definitive diagnosis is just as important in the practice of veterinary medicine as it is in human medicine. However, economic factors, which play a greater role in veterinary medicine, often preclude the use of more sophisticated diagnostic procedures, thus preventing an accurate determination of the cause of illness or death.

Another obstacle blocks attempts at gathering accurate data on the zoonoses. Many infectious diseases transmissible to human beings either pass unnoticed by the owner of an animal or are a diagnostic enigma to the practicing veterinarian. Q fever, to the best of our knowledge, causes no clinical illness in domestic animals (*1*); trichinosis is rarely diagnosed clinically in swine (*2*); and psittacosis may go undetected for weeks or months in psittacine birds (*3*).

Dr. Schnurrenberger and Dr. Russell are both veterinary epidemiologists, division of communicable diseases, Ohio Department of Health, Columbus. *The article is based on a paper given by Dr. Schnurrenberger at the annual meeting of the Indiana Public Health Association, Indianapolis, May 8, 1959.*

A classic exception to this statement is rabies, in which the usual clinical symptoms are quite striking and almost invariably end in death in both human beings and animals. The disease as it occurs in bats may belie this, for present evidence strongly indicates that the order Chiroptera is capable of harboring the rabies virus for long periods without dying and occasionally without evidencing clinical illness (*4*).

Once a diagnosis has been obtained, there are still many difficulties in getting the necessary statistics, since relatively few areas have a well-developed system for reporting the morbidity and mortality of domestic animals. Even these areas have difficulty formulating baseline data on animal populations. Numbers of animals, age and sex distributions, and age-specific death rates are unobtainable, even for purebred registered livestock.

Another complicating factor is the relatively short lifespan of domestic animals. When we realize that much poultry reaches market at the early age of 10–12 weeks, lambs at 4–5 months, swine at 5–5½ months, and cattle at 12–18 months, it becomes apparent that the disease experiences of these animals occur over an extremely short period.

Among commercial livestock, only with breeding animals and dairy cattle do we have a sufficient age differential to add materially to our knowledge of the natural history of disease. And in these animal populations, man has drastically altered the normal sex ratio.

Our companions, the dog and cat, despite all our efforts to prolong life, are totally unable to cope with the nemesis of civilization, the automobile. The mean lifespan of these animals is estimated at less than 5 years (*5*).

Factors such as these necessitate a somewhat different approach to the task of defining and coping with animal populations at risk of disease than that followed with human populations. The zoonoses are peculiar in that human-to-human transmission is rare. Human beings become infected only as a side chain and are of minor importance as reservoirs. Thus, to prevent human infection, we must control the disease in animals (*6*).

Since rabies is one of the zoonoses in which the diagnosis is somewhat less difficult and reporting of cases is relatively accurate, it might be of interest to review a recent experience with this disease in Ohio. Because man lives in much more intimate contact with dogs than with any of the other common transmitters of rabies, the primary concern is the elimination of canine rabies, for, according to Lepine (*7*), 86 percent of the human cases of rabies are contracted from dogs.

One of the prime considerations in disease control is surveillance. No outbreak can be controlled unless it is first recognized. One technique of surveillance is spot mapping cases to disclose geographic foci of infection. Figure 1, depicting the total number of cases of animal rabies in Ohio in 1955, shows an enzootic area in the extreme southern portion of the State, primarily in Lawrence and Scioto Counties. In that year, 243 cases were reported throughout the State, 141 in dogs.

A comparison with figure 2, the 1956 rabies cases in Ohio, indicates an increase in both the total (300) and the cases in dogs (214). The disease had spread into two contiguous counties, Jackson and Pike. In 1957, rabies continued to be the most serious in the original two counties and in those neighboring counties to which the enzootic had spread (fig. 3).

In the 3-year period (1955–57) Jackson, Lawrence, and Scioto Counties with less than an estimated 1 percent of the State's dog population (based on human population figures) were responsible for 65 percent of the reported cases of canine rabies. In 30 of the 36 months, cases from these three counties equaled or exceeded the total number from the other 85 counties of the State.

A breakdown of the animal species with the disease during the 3-year period in these three

Figure 1. Locations of 243 cases of animal rabies (141 in dogs) reported in Ohio, 1955

counties revealed that more than 95 percent of the reported cases were in dogs, with most of the remaining 5 percent in wildlife. Investigation of individual case reports showed that nearly one of every four cases of rabies was in a stray dog.

The situation was complicated by lack of public awareness or concern.

The approach to rabies control in this situation was fourfold: education, immunization, control of strays, and surveillance of wildlife. Control programs were started in the three counties between April 1957 and May 1958.

Education

Because apathy is more difficult to overcome than ignorance, the educational approach, in addition to stressing the public health dangers, emphasized the fact that considerable sums of money had been expended in these counties on antirabies treatment of exposed individuals. This expenditure, continued in 1958, was contributing nothing toward the elimination of the reservoir of the disease.

According to the county auditor's records, in one county with a population of less than 54,000, more than $4,000 had been spent for

Figure 2. Locations of 300 cases of animal rabies (214 in dogs) reported in Ohio, 1956

Figure 3. Locations of 288 cases of animal rabies (153 in dogs) reported in Ohio, 1957

antirabies treatment and supplementary medical care for 110 persons during the 3-month period January–March 1958. (A fee of $2 per injection was charged for the course of treatment.) However, the situation was growing worse, and in February 1958 there was a human death caused by rabies. These data and objective facts about rabies were presented to the public through the usual mass communications media.

Since a large proportion of the dogs in Ohio are children's pets, we decided to concentrate one phase of the educational effort in the public school system. A total of 40,000 children, approximately 90 percent of the total enrollment of Jackson, Lawrence, and Scioto Counties, attended a special program, consisting of a description of the situation, a movie on rabies, a question and answer period, and the distribution of fact sheets. These programs in the schools took place 2 or 3 days before a vaccination clinic for animals was scheduled for that area. It is our feeling that the school programs were effective in getting publicity on the rabies control efforts into the homes and that they were probably the most successful phase of the educational approach.

The remainder of our efforts, like many other communicable disease control programs, were designed to separate susceptible animals from shedding animals, that is, to break the chain of infection.

Vaccination Clinics

The vaccination clinics were operated on the premise that the person with sufficient sense of responsibility to obtain a dog license will immunize and confine his pet when he learns rabies exists in the area. Our objective was to vaccinate the unlicensed dogs. To eliminate obstacles and make it as convenient as possible for owners to cooperate, at least two mass clinics were held in each area of population concentration. Licensure was not necessary for immunization at these public clinics. The cost of immunization was low. The vaccine was purchased by the county commissioners and administered by local veterinarians for a $1 fee per dog. Chick embryo vaccine was used at the clinics.

Since two of the counties with a high rabies incidence had only one practicing veterinarian, every effort was made to conduct the clinics as efficiently as possible. Local and State health department and volunteer personnel assisted

and approximately 100 dogs per hour were handled without difficulty. Clerical and manual assistance from local service clubs and women's clubs created a feeling of community participation in the clinics.

The clinics were conducted in essentially the same manner throughout the three counties. Every effort was made to publicize each clinic in advance and to hold them in such locations that everyone was within reasonable proximity of at least one clinic.

In Lawrence County, with 49,000 people in 456 square miles, it was necessary to schedule 26 clinics because of the scattered population and bad weather and poor roads at that time of year. Despite these handicaps, a total of 5,670 dogs and cats were vaccinated at the clinics, and more than 500 other animals by private practitioners during March 1958. At only one clinic were fewer than 100 animals vaccinated. Thus, more than 6,000 animals were immunized in Lawrence County during 1 month, although the county had issued only 2,897 dog licenses during 1957.

Control of Strays

A countywide 90-day quarantine was the first step in intensifying the control of stray animals. Any dog found running loose was impounded regardless of licensure or immunization status, and none was permitted to leave the pound without first being immunized.

The dog warden was thoroughly indoctrinated with the importance of his work in the control effort and the necessity of his thoroughly understanding all the effects of rabies.

Local police officers assisted the regular warden in picking up stray dogs. Home call service for unwanted pets was started to decrease the practice of dropping the animals along the roadside where they would become strays to be captured later. Revamping the dog-holding facilities was necessary to permit greater segregation of suspect animals.

Wildlife Surveillance

In these counties rabies in wildlife did not appear to be an immediate threat despite an apparently numerous wildlife population. This phase of the rabies control program was confined to surveillance. Whenever possible an accurate, definitive diagnosis on wildlife deaths was sought, and reports of wildlife seen acting in a suspicious manner were investigated.

Evaluation

In a program of this nature, we can evaluate the results only by comparing the incidence of cases before and after controls have been implemented. Other factors such as the normal seasonal fluctuation of a disease may affect the results.

However, in this three-county area enzootic rabies had prevailed for years, with an average of 109 cases of canine rabies annually for the 1955–57 period. Moreover, in the 5 previous years, the incidence of rabies had been unusually high, although varying in intensity from year to year.

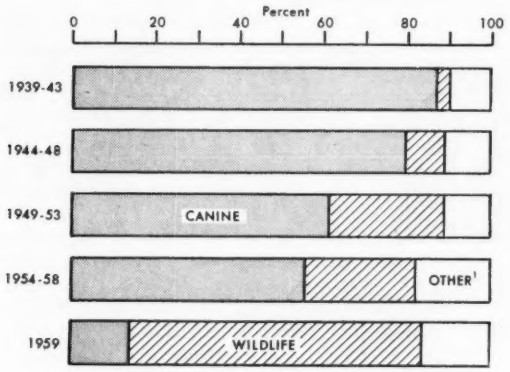
In the beginning, the center of the enzootic area seems to have been Lawrence and Scioto Counties, with the disease slowly growing in intensity and spreading into surrounding counties. During the 1955-57 period the number of human exposures to rabies grew to such a size as to create an intolerable public health situation, and in 1958, two persons died from rabies

Effect of organized control programs on canine rabies in three Ohio counties

County	Date of program	Number vaccinated in program	Number dogs licensed, 1957	Number cases 12 months preceding	Number cases 12 months following	Months since last case [1]
Jackson	April 1957	5,070	2,803	69	7	32
Lawrence	March 1958	6,170	2,897	40	1	24
Scioto	May 1958	3,800	7,829	33	1	19

[1] As of January 1, 1961.

Figure 4. Species distribution of rabies cases reported in Ohio, 1939–59



[1] Livestock, cats, and man.

in Ohio, one death occurring in the three-county area and the other in a nearby county.

The table compares the incidence of canine rabies for the year before and the year following a countywide control program. For purposes of evaluation the following year was a 12-month period starting a full month after the control program in a particular county had ended. (Maximum immunity following vaccination takes 3 to 4 weeks to develop.)

Investigation revealed that at least two of the Jackson County cases in the year following its control program actually originated in the surrounding counties that lacked such organized programs. Scioto County had attempted partial control programs in 1956 and in 1957, when 5,000 dogs were vaccinated, but the number of vaccinations performed was apparently insufficient to control the disease effectively. Although the programs may have had some beneficial effect, the numerous dog population required a larger number of immunizations than were performed.

In addition, Scioto County, adjacent to other enzootic areas without control programs, permitted infected animals to enter the county. More than 90 percent of the Scioto County cases occurred in the eastern half, adjacent to Jackson and Lawrence Counties. The Scioto River, flowing north to south, apparently formed a natural barrier which was relatively effective in preventing spread of rabies to the western half of the county.

The three-county area has had only two cases of canine rabies in the 24 months since the last control program was concluded in June 1958. The number of human exposures has been negligible compared with the hundreds who received treatment annually before the control efforts.

The decline of rabies in this area has meant a drastic reduction in the number of canine rabies cases for the entire State. The 1953–57 mean of 152 dropped to 71 cases reported in 1958, 15 in 1959, and 9 in 1960. Only 22 cases of canine rabies were reported for all of Ohio in the 12 months following the last program.

This change in incidence has so altered the species distribution of rabies in Ohio (fig. 4) that the major emphasis in control is being shifted from the canine to the wildlife population. In 1959, 70 percent of the cases were in wildlife and only 14 percent in dogs.

Summary

Economic factors, undiagnosed illnesses of animals, and their relatively short lifespan hamper efforts to gather vital statistics on the zoonoses. Rabies, at least in most animals, is the classic exception to this.

Enzootic rabies in a southern Ohio area accounted for 65 percent of the State's reported cases of canine rabies for a 3-year period. Hundreds of persons received antirabies treatment, but little was done to eliminate the reservoir of the disease.

Control programs were conducted between April 1957 and May 1958 in Lawrence, Jackson, and Scioto Counties. To combat public apathy, the cost of treatment as well as the threat to public health was stressed. Programs in the schools alerted children and their families to the situation and publicized vaccination clinics for unlicensed dogs.

At the clinics, held wherever there were population concentrations, pets were immunized for a $1 fee at the rate of 100 per hour. In Lawrence County more than 6,000 animals were immunized, although the county had issued less than half that number of dog licenses the previous year.

Only two cases of canine rabies have occurred in the three counties since the control programs

ended, and, in Ohio, the species distribution of rabies has been drastically altered. Major emphasis in control in the State is being shifted from the canine to the wildlife population.

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Challenges of the Sixties

"Challenges of the Sixties" was the theme of the 11th annual meeting of the Middle States Branch of the American Public Health Association held April 27–29, 1960, in Indianapolis, Ind. Among resolutions adopted at the meeting, the Middle States Branch included the following recommendations:

- Assumption of responsibility by every professional discipline concerned with public health programs for increasing the knowledge of accident prevention among its professional workers.
- Assignment by the health officer to one staff member of the responsibility for coordinating accident prevention activities of the public health team.
- Inclusion of nutrition, dental health, and rehabilitation in home care programs that are cognizant of the needs of children and adolescents as well as of older age groups.
- Development or extension of community programs to meet the nursing care needs of patients in their own homes, with continual evaluation by the public health nursing profession and other public health disciplines in terms of patients' needs.
- Development of guidelines by State official and voluntary health agencies for establishing homemaker or housekeeper programs.
- Application of health education skills to support sound accounting, performance evaluation, budgeting, and promotion of health programs.
- Study of costs of sanitation services to provide guides for communities and health departments as an aid to programing and financing, with emphasis on man-hours rather than cash.
- Expansion of training courses in radiological health.
- Encouragement of comprehensive State programs for rehabilitation by establishment of a central State planning and coordinating agency; promotion of the rehabilitation concept in nursing education and services; and inclusion of nutrition and dental health in rehabilitation programs.
- Provision of training in rehabilitation techniques by States with rehabilitation facilities in hospitals or other agencies.

Topical Applications of Fluoride Solutions in Dental Caries Control

FRANK E. LAW, D.D.S., M.P.H., MARGARET H. JEFFREYS, M.P.H., and HELEN C. SHEARY, B.S.

BOTH sodium fluoride and stannous fluoride in solutions of various concentrations have been used as topical agents, and their effectiveness as dental caries preventives among school children has been reported. A series of four applications of 2 percent solution of sodium fluoride to the teeth of children has been shown to reduce the incidence of dental caries by approximately 40 percent (*1, 2*). Reports on the effectiveness of 2 and 8 percent concentrations of stannous fluoride solution, topically applied, have varied widely among different workers (*3–7*).

This study was designed to explore the relative caries-inhibiting effectiveness of sodium fluoride and stannous fluoride solutions under like controlled conditions. To establish comparability between this investigation and those conducted earlier, corresponding concentrations and procedures were chosen. The three study groups compared results observed after four applications of 2 percent sodium fluoride solution, four applications of 2 percent stannous fluoride solution, and one application of 8 percent stannous fluoride solution.

Participants were elementary school children residing in five Delaware communities. The water supplies in these areas were essentially fluoride free. A residence history was obtained for each individual, and children with more than 2 years' absence from the community at any time were omitted from the final evaluation. The residence requirements were established to insure that participants had not received the benefits of fluoride-bearing water.

Dr. Law is chief and Miss Sheary is dental hygienist in the Disease Control Branch, Division of Dental Public Health and Resources, Public Health Service. Miss Jeffreys is director, division of oral hygiene, Delaware State Board of Health.

Materials and Methods

There were 884 children 7 to 13 years of age in Sussex and Kent Counties, Del., who met the residence requirements for participation in the study. Of this number, 823 children received the prescribed treatments and were present for the final 12-month reexamination. Study groups were set up by school so as to produce approximately equal numbers of children for participation in the evaluation of each of the three fluoride application procedures to be used (table 1). The three study groups showed similar rates of prevalence of dental caries at the beginning of the study.

A dental prophylaxis preceded the initial examination. All examinations were made by the same examiner using a No. 4 plane mouth mirror, double-end No. 5 explorer, artificial light, and portable dental chair, with compressed air available as required. Dental prophylaxis was not given prior to the second examination.

The 2 percent sodium fluoride solution was prepared daily. The stannous fluoride solutions (2 and 8 percent) were prepared four times daily because this compound is unstable in aqueous solution and susceptible to chemical change. Distilled water was used in the preparation of all solutions.

The first group of children received four applications of 2 percent sodium fluoride solution. The second group received four applications of 2 percent stannous fluoride solution. Applications were made at 2- to 7-day intervals. The

Table 1. Age distribution of 823 children available for reexamination at the end of 12-month period, by procedure

Study procedure	All ages	Age, in years, at time of treatment						
		7	8	9	10	11	12	13
4 applications 2 percent sodium fluoride	269	31	50	61	52	38	22	15
4 applications 2 percent stannous fluoride	273	28	43	65	50	45	30	12
1 application 8 percent stannous fluoride	281	42	54	52	37	41	32	23

Table 2. Dental caries experience of 823 children during a 12-month period in permanent teeth of fluoride-treated and untreated mouth quadrants

Study procedure	Number sound teeth May 1957	New DF[1] teeth May 1958		New DF[1] surfaces May 1958	
		Number	Percent	Number	Percent
	Both jaws				
4 applications 2 percent sodium fluoride:					
Treated quadrants	1, 526	103	6. 7	118	7. 7
Untreated quadrants	1, 540	159	10. 3	184	11. 9
4 applications 2 percent stannous fluoride:					
Treated quadrants	1, 542	100	6. 5	117	7. 6
Untreated quadrants	1, 562	151	9. 7	171	10. 9
1 application 8 percent stannous fluoride:					
Treated quadrants	1, 601	134	8. 4	148	9. 2
Untreated quadrants	1, 630	165	10. 1	197	12. 1
	Upper jaw				
4 applications 2 percent sodium fluoride:					
Treated quadrants	672	62	9. 2	70	10. 4
Untreated quadrants	669	85	12. 7	100	14. 9
4 applications 2 percent stannous fluoride:					
Treated quadrants	688	64	9. 3	73	10. 6
Untreated quadrants	686	95	13. 8	104	15. 2
1 application 8 percent stannous fluoride:					
Treated quadrants	716	80	11. 2	85	11. 9
Untreated quadrants	738	92	12. 5	109	14. 8
	Lower jaw				
4 applications 2 percent sodium fluoride:					
Treated quadrants	854	41	4. 8	48	5. 6
Untreated quadrants	871	74	8. 5	84	9. 6
4 applications 2 percent stannous fluoride:					
Treated quadrants	854	36	4. 2	44	5. 2
Untreated quadrants	876	56	6. 4	67	7. 6
1 application 8 percent stannous fluoride:					
Treated quadrants	885	54	6. 1	63	7. 1
Untreated quadrants	892	73	8. 2	88	9. 9

[1] Decayed or filled.

third group received one application of 8 percent stannous fluoride solution. In each group one side of the mouth was treated and the other half provided the control. Approximately one-half of the children in each group were treated in right mouth quadrants and the remainder in left mouth quadrants. The application technique followed the method described by Knutson (*8*).

Results

The dental caries experience of the 823 children during a 12-month period is shown in table 2.

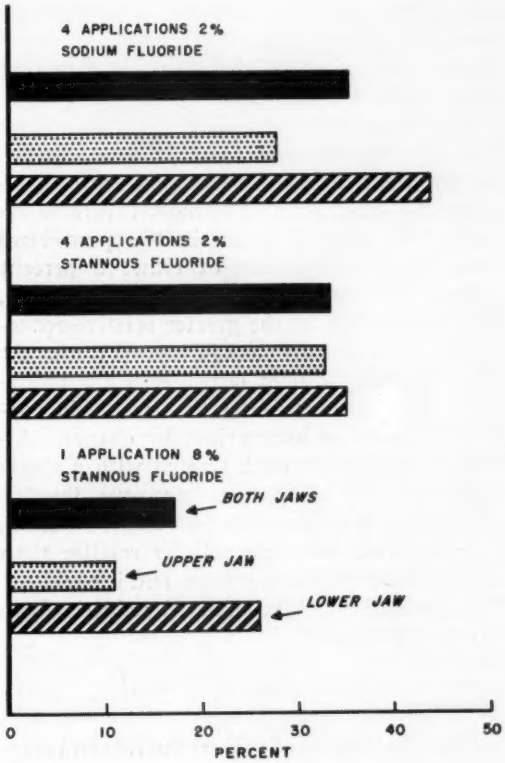
In untreated mouth halves the incidence of new dental caries was remarkably similar in the three study groups during the 1-year study period. The percentage of untreated sound permanent teeth becoming carious ranged, by group, from a low of 9.7 percent to a high of 10.3 percent.

In treated mouth halves the percentage of new dental decay in the course of the study year was approximately equal in two of the study groups: for children treated with 2 percent solution of sodium fluoride, 6.7 percent; and for those with 2 percent solution of stannous fluoride, 6.5 percent. The incidence of new caries was 8.4 percent for the group treated with 8 percent stannous fluoride solution.

Table 3. Percent less new caries in fluoride-treated than in untreated previously sound permanent teeth of 823 children during a 12-month period

Study procedure	Upper jaw	Lower jaw	Both jaws
	Percent less newly carious teeth		
4 applications 2 percent sodium fluoride	27. 6	43. 5	35. 0
4 applications 2 percent stannous fluoride	32. 6	34. 4	33. 0
1 application 8 percent stannous fluoride	10. 4	25. 6	16. 8
	Percent less newly carious surfaces		
4 applications 2 percent sodium fluoride	30. 2	41. 7	35. 3
4 applications 2 percent stannous fluoride	30. 3	31. 6	30. 3
1 application 8 percent stannous fluoride	19. 6	28. 3	24. 0

Percent less newly carious teeth in fluoride-treated than in untreated permanent teeth, by procedure



The experience in the three study groups was similar for upper and lower teeth separately, although the rate of new dental caries incidence was somewhat higher in upper than in lower teeth in both treated and untreated mouth quadrants. In each treatment group the number of newly decayed tooth surfaces in previously sound permanent teeth followed a pattern similar to that of the newly carious teeth (table 2).

Percentage reductions in the incidence of newly carious teeth and of newly carious surfaces in previously sound teeth are shown in table 3 and the chart.

There were 35 percent fewer new carious teeth in treated as compared with untreated

mouth quadrants following four applications of 2 percent sodium fluoride solution and 33 percent fewer after four applications of 2 percent stannous fluoride solution. The reduction was substantially less, 16.8 percent, for teeth treated with a single application of 8 percent stannous fluoride solution.

The topical fluoride study in Delaware shows that all fluoride-treated mouth quadrants incurred a lower incidence of new caries than untreated quadrants. The most favorable results were obtained from the two procedures using four applications of either 2 percent sodium fluoride or 2 percent stannous fluoride, as demonstrated by the greater relative reductions in new dental caries in treated teeth. At the 5 percent level of significance the reductions observed are greater than would be considered likely to have arisen by chance. Although permanent teeth treated with a single application of 8 percent stannous fluoride showed a lower caries rate than untreated teeth, the reduction was substantially smaller than in the other treatment groups, and it could not be concluded that the observed reduction was not due to chance.

Summary

The effectiveness of sodium fluoride and stannous fluoride as dental caries preventives was tested in three groups of school children 7–13 years of age. One group received four applications of 2 percent sodium fluoride solution, another group was treated with four applications of 2 percent stannous fluoride solution, and a third group received one application of 8 percent stannous fluoride solution. In each group one side of the mouth was treated and the other served as control.

Results of this study, 12 months after the initial examination, indicate that the incidence of dental caries was significantly lower in noncarious permanent teeth treated with four applications of 2 percent sodium fluoride solution or 2 percent stannous fluoride solution than in untreated teeth. Their effectiveness was essentially the same.

One application of 8 percent stannous fluoride solution was considerably less effective in preventing dental caries than either of the other two procedures. The reduction in the incidence of dental caries obtained by this procedure was not statistically significant.

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Governmental Responsibilities in Environmental Health

LEROY E. BURNEY, M.D.

AS I was having lunch in a hospital a couple of weeks ago, my eyes began to water and burn. The presumptive diagnosis was smog. I was in Los Angeles, a city of 6 million people and 3 million automobiles.

In this instance, I was being exposed to an environmental health hazard which produced an immediate, subjective symptom. For the many other environmental pollutants and conditions to which I was exposed on the same day, and to which all of us are exposed on every day of our lives, no such convenient, though uncomfortable, indicators exist. These, of course, include other chemicals present in air and in our water supplies, the additives in our food, the tensions, strains, noise, and vibrations characteristic of our urbanized and industrialized Nation, and the ionizing radiations which bombard us from both manmade and natural sources.

As we prepare to meet these new challenges, we in the health professions find ourselves entering into many new alliances. We discuss ionizing radiations with nuclear physicists, air pollution with meteorologists, and water pollution with chemical engineers and aquatic biologists. These things seem far removed from the medical curriculums which many of us studied 20 or 30 years ago. Yet they are fundamental to the health of the American people in the coming years.

Dr. Burney, Surgeon General of the Public Health Service from 1956 to 1961, delivered this address at the annual meeting of the American Institute of Chemical Engineers held in Washington, D.C., December 7, 1960.

Accompanying this diversification of the health sciences has been a progressive complication of economic, social, and political patterns within which we carry on our work. Thus, while we are exploring new sciences on the one hand, we are also seeking to develop new modes of cooperation and interaction in the administrative and governmental fields.

Clearly, all levels of government must be deeply involved if we are to create and maintain a safe and healthful environment. Because both the causes and the effects of the new health challenges are nationwide in scope, the Federal Government has a vitally important role. There are equally cogent reasons for acceptance of responsibilities by State governments, by metropolitan agencies, and by strictly local units. Related responsibilities should logically be borne by nongovernmental organizations.

Generally speaking, prior to World War II, environmental health was viewed in terms of microbiological problems. The public health concern with water pollution related to biological contaminants. Community air pollution was localized, and control, for the most part, was smoke abatement and soot removal.

However, the war-spawned upsurge in scientific advancement and the postwar pattern of accelerating technology and population behavior have broadened considerably the public health base of environmental health. Biological contaminants in the environment are still a major factor. But now the complex chemical contaminants, their behavioral patterns in air and water and their composite and synergistic effects, need special attention. The

unprecedented speed with which we are developing and using new substances and new materials has outdistanced our ability to determine and control their composite impacts on public health and well-being.

We need to keep in mind the predicted metropolitan-industrial growth factors. Currently 100 million people, 150 percent more than in 1940, depend on surface streams for drinking water. By 1980 this figure will be 165 million. In 1970, three out of four people in the United States will be breathing the air over only 10 percent of the total land area.

Obvious questions are: At what point on this fantastic growth curve will we be in serious trouble? And just what will be the nature and extent of that trouble?

In seeking answers to these questions, the Public Health Service and other agencies have established programs designed to explore the medical and biological impact of various contaminants and to monitor public exposure to these hazards. The following discussion on chemical contaminants in water and air is a report of the Public Health Service's national monitoring networks on water and air.

Challenge of Chemical Contaminants

Our drinking water nowadays contains an assortment of organic chemicals, many of them of industrial origin. The kinds and amounts of chemicals added to food are usually known, and suitable controls to protect health can be established. Yet water contains additives of unknown composition and in unknown concentrations. None of these additives improve the water, many of them damage its quality, and some may harm the consumer.

Concentrations of synthetic organics in water are low, usually ranging from 20 to 500 micrograms per liter. Nevertheless, even 1 microgram per liter of some chemicals causes difficulty. Chlorophenol causes taste in water, and endrin, a chlorinated insecticide, kills fish at this level.

One chloroform extract recently recovered from a river, and from the drinking water of a city using the river as a supply, has shown the presence of naphthalene, diphenyl ether, styrene, acetonitrile, ethylbenzene, tetralin, and chloroethyl ether. In another instance a toxic type of chemical was found in the Mississippi River from St. Louis to New Orleans, a distance of 1,000 miles.

Water consumers in some locations receive these mixed chemicals in amounts from a few micrograms to 1 or 2 milligrams per day. Whether a constant dosage of mixed organic chemicals occurring in drinking water can be harmful to humans is not known; the types of chemicals which have been recovered make it evident that we should find out.

Turning to the air pollution field, chemicals from chemical and metallurgical industrial sources contribute a large variety and tonnage of pollutants to the atmosphere as well as to water. However, the combustion of fuels contributes still greater variety and tonnage. Flames in furnaces and open fires and explosions in internal combustion engine cylinders synthesize many larger and more complex molecules than in the parent fuels, and fix atmospheric nitrogen. These reactions continue in the open atmosphere. These larger molecules result in the eye-irritating, plant-damaging, visibility-reducing smog of cities. A forecast of future energy usage shows large increases in consumption of coal, gas, and petroleum during the next 20 years, despite the advent of nuclear power.

The National Air Sampling Network monitors these airborne chemicals in 250 cities and nonurban sites, analyzing samples for 30 specific inorganic substances, and producing several organic fractions (aromatic, aliphatic, oxygenated-neutral) from which a number of organic substances have been isolated. These organic fractions are being tested in experimental animal colonies at the National Cancer Institute and at the University of Southern California for tumor production. To date about 20,000 samples have been obtained and more than 100,000 chemical analyses made.

One of the more than 30 substances found in community air, which the Public Health Service is analyzing, is benzo(a)pyrene, also known as 3-4 benzpyrene, a representative of a larger class of polynuclear hydrocarbons which are presumed to have significance in the causation of cancer. According to our surveys, a person breathing nonurban air would inhale

approximately 1 microgram of benzo(a)pyrene per year. The smoke from one pack of cigarettes per day would contribute about 60 micrograms per year. But a person inhaling the air in some cities would take in from 110 to 150 micrograms of benzo(a)pyrene per year.

The chemical findings reported here offer a supreme challenge to the public health physician. Our problem is one of chronic exposure—lifelong, 24 hours a day. Lead, for example, is present in our food, air, water, and tobacco, coming from such sources as agricultural sprays and automobile exhausts. The source of such a cumulative poison is less important than total exposure. Does our increasing use of tetraethyl lead in gasoline present a hazard, upsetting a delicate balance presently assumed to have a margin of safety? Or, examine sulfur dioxide, perhaps the commonest air pollutant. Apparently not cumulative, as is lead, its action appears to be one of repeated insult and irritation which may increase susceptibility and enhance the action of toxic agents. Do detergents in water act in toxic fashion, or do they increase cell permeability to aid the introduction of more injurious substances?

What about carcinogens in water and air? The urban-rural and the national distribution of excessive lung cancer mortality statistics suggest similarities to those of benzpyrene in air, although there are outstanding exceptions. Are there other agents in the cities, in rivers, in the air? Are there other factors such as crowding, culture, food, and background radiation? These questions pose problems for public health practice, for control action and prevention.

Implications of Ionizing Radiation

No discussion of our new environment as it affects our health would be complete without consideration of the health implications of ionizing radiation, dramatized by the upsurge of nuclear energy and its byproduct, radioactive isotopes, with manifold uses in medicine, industry, and research. To this must be added the X-ray, which not only has brought enormous benefits as a medical tool but which, improperly used, adds appreciably to the health problems of the nuclear age.

A hint at the vast scale of health implications of the rapidly developing nuclear age is given in a report of the National Advisory Committee on Radiation:

- Between 1925 and 1955, the estimated annual whole-body X-ray doses received by the average individual in this country increased 900 percent, from 15 millirems in 1925 to 135 millirems in 1955.
- Between 1952 and 1958, the number of medical users of radioisotopes in the United States increased more than 400 percent, from 445 to 1,935.
- The predicted growth of U.S. nuclear power capacity from 1956 through 1995 will result in an increase in the accumulated volume of high- and intermediate-level wastes from 1,500,000 gallons to approximately 2 billion gallons.

Understanding the impact of radiation on living organisms is a particularly formidable challenge because it differs radically from phenomena with which we are more familiar. In radiation we are dealing with subatomic particles and forces. Since these exert their effects physically by means of high energies, they cause profound changes in living cells and tissues.

A tremendous amount of research has been done and a great deal is known about the health effects of ionizing radiations in relatively heavy dosages. It is well established, for example, that exposure to high but sublethal levels of radiation has three different kinds of deleterious effects on groups of laboratory animals: a general shortening of the lifespan, increased frequency of genetic mutations, and increased incidence of cancer.

Whether or not threshold levels for these effects exist, and if so what they are, comprises one of the most important of our research problems. Meanwhile we are compelled to assume, first, that any radiation is harmful at the cell or tissue level; second, that damage done is irreversible; and third, that radiation damage is, therefore, cumulative throughout a person's lifetime.

These, then, are among the health challenges of the contemporary environment. It is tempting to try to deal with them separately, in neatly packaged compartments labeled water pollution, air pollution, radiation, and so on. In

fact, however, they are so interwoven, and so mutually reinforcing, that they can be dealt with most effectively if they are considered as parts of an interrelated whole, the total environment of modern man. Just as health itself is indivisible, so the environment is indivisible in its impact on human beings.

This environmental health problem differs from traditional health concerns in several important ways, some of which I have already suggested.

The first of these is the nature of the biological assault. The health professions and the public are accustomed to the communicable disease pattern, in which the timespan between exposure and onset is relatively short. Cause and effect relationships are relatively easy to establish, leading directly to preventive measures upon which much of public health and individual medical practice have been developed.

However, the health effects of chemicals and ionizing radiation often are far off in the future of the individual or even, in the case of radiation, of the species. Predicting those effects and relating them to cause is extremely difficult. The hazard to the individual is related to the cumulative total of minute quantities of radiation or chemical toxicants received continuously or intermittently throughout his life, regardless of their source. The genetic hazard to the species from low-level radiation, and possibly from chemicals, must be extrapolated far into the future and thus is even more difficult to assess.

Apportionment of Responsibility

A second fundamental difference between the new environmental problems and the more traditional health problems has to do with governmental and administrative patterns. Perhaps the greatest challenge that we face lies in the complexity of the political, social, and economic structure within which solutions must be found and applied.

It has been a long-standing principle in public health, as in many other fields, that the fundamental responsibility rests with the local community. And, having uttered the magic phrase "community responsibility," we seem to assume that clearly defined, firmly established communities exist which claim the unswerving loyalty of a certain specific group of people, generally referred to as "citizens," who have complete control of their collective destiny.

To the best of my knowledge, few such communities exist in our metropolitanized, industrialized Nation. Certainly they do not represent the dominant mode of existence in contemporary America. Instead, most of us live in a set of interlocking and overlapping communities which function, or fail to function, on a number of levels. We live in a subcommunity which gets its name from a housing development or shopping center. This is part of a suburb, which, in turn, is one of a number of satellites of a central city. This metropolitan complex almost undoubtedly occupies more than one county, and it may sprawl across two or three State lines.

Meanwhile, too often, this complex is being served by an administrative and political structure erected in horse-and-buggy days, when county seats were spaced a day's journey apart. The metropolis is the fact; the jurisdictions are, in the present context, fiction. "Local responsibility," in terms of modern environmental health problems, covers a multitude of localities sharing a common air supply, a common water supply, a common background of natural and manmade radiations, but usually lacking common administrative machinery.

Superimposed on this governmental tangle is the problem of economic responsibility in private enterprise. Some of the modern environmental pollutants are byproduct wastes of industrial production. Others, automotive exhaust is the most obvious, result not from the manufacturing process but rather from the use of the product. Still others, for example the use of radiation in medicine, result from the supplying of direct services to individuals.

In dealing with a microbiological threat to health, we can go all out for total eradication. But the microchemical and microphysical hazards are undesirable effects of highly desirable processes. We must seek not eradication but containment. We need to evolve relationships and apportion responsibilities which permit full utilization of modern technology at minimum hazard.

Plainly, there are three broad avenues of ap-

proach which must be followed simultaneously and at accelerating speed if we are to strike this kind of balance:

First, research programs which provide knowledge as to the health effects of specific environmental pollutants, singly and in combination, cumulatively over periods of years.

Second, comprehensive environmental monitoring programs to maintain a continuous check on the nature and degree of population exposure to these pollutants.

Third, the development and application of control procedures to eliminate unnecessary exposure wherever it may occur.

The key word here is "simultaneously." The need for more knowledge cannot justify needless delay in the application of controls. We are confronted by health problems which develop over periods of years or even generations. To wait until the final proof is in before taking steps to reduce pollution would be indefensible at best and suicidal at worst.

This is the nature of the road ahead. The governmental problem in environmental health is: Who shall be responsible for what? It demands hard, cold, realistic answers.

In the Public Health Service we are in process of regrouping and strengthening our forces to deal effectively with what we conceive to be our areas of special responsibility.

Administratively, our programs in water pollution control, air pollution, radiological health, and occupational health have all been raised to the status of operating divisions within the past 3 years. Congress has under consideration combining these and related programs into a new Bureau of Environmental Health, parallel organizationally to the three existing bureaus.

This new bureau will provide for the integration of the medical and engineering components of our environmental programs, and make optimal use of the many research and other methods which are applicable across the board in environmental health. It will combine a strong intramural research program with an extensive extramural, grant-supported program making use of laboratories of universities, industrial organizations, and other agencies.

Meanwhile, our research effort has already been greatly augmented, especially in air pollution and radiation. We are conducting and supporting studies of the biomedical effects of specific pollutants and controlled radiation doses on laboratory animals. We are carrying out broad-scale epidemiological studies designed to detect relationships which may exist between specific disease conditions and environmental exposures. We are, as I have already noted, widening the coverage of our monitoring networks in water, air, and radiation.

In addition to its function in research and investigation, the Public Health Service is assisting State and local health agencies to develop vigorous and effective environmental health programs. To date, their interest and willingness to undertake such activities has run far ahead of the supply of available personnel; for this reason, a very sizable portion of our environmental health funds is being devoted to technical training. The Sanitary Engineering Center at Cincinnati, long overburdened, has been supplemented by three regional radiological health laboratories at Montgomery, Ala., Las Vegas, Nev., and Rockville, Md., designed to serve the States in their respective regions. Numerous State and local agencies are already supplying invaluable baseline data and making other important contributions to environmental health protection. We look forward confidently to more of the same.

This upsurge of interest at all levels of governmental health administration is most heartening. It represents a basic change of attitude by the public health profession, and a broadening definition of public health.

Water and Society

ABEL WOLMAN, Dr.Eng.

IN the United States, blessed with reasonably comprehensive water services, the public health implications of water supply have become less and less dramatic because of the almost total elimination of the familiar waterborne diseases of the early 20th century. The disappearance of typhoid fever and other enteric diseases in much of the Western World has resulted in a declining interest of most health workers in the field of water supply.

In this favorable environment, however, the provision of water service in expanding urban areas remains one of the major problems of society. So accustomed have our citizens become to unlimited amounts of excellent quality water that they assume, from past experience, that their requests for this service will be met automatically by private and public enterprise. This assumption, however, is not supported by the results. In some parts of the Western World, due to natural causes and to unprecedented urbanization, rationing of water is almost universal and continuous.

When we move out of the Western World the situation has few favorable characteristics. More than three-quarters of the total population of the world lacks true community water service and few have water of high quality. Comprehensive communal water systems which either reach into the house or are adjacent to the place of living are virtually unknown in vast areas. The consequent toll in waterborne disease is characteristic of western experience in the late 19th century.

Resources in Selected Areas

In the United States in 1954, the total withdrawals from streamflow for irrigation, mining, manufacturing, steam electric power, and municipal water supplies was somewhat over 300 billion gallons per day. By 1980 this amount will approach some 560 billion gallons per day.

Before these astronomical figures cause too much alarm it should be emphasized that, with the exception of irrigation uses, a large part of these withdrawals are returned to the streams. A more informative set of figures, therefore, would indicate that the actual consumption of water will rise in the United States, from 110 billion gallons per day in 1954 to 120 billion in 1980. It is heartening to remember also that in these 2 years consumption represents only some 10 to 11 percent of the average streamflows.

Water availability is a function of place, time, and climate. Average figures obviously do not disclose that some areas of the United States will encounter water difficulties earlier and to a greater degree than others. It is extremely doubtful, however, that scarcity of water, at least in the United States, will impose a serious restriction on growth now or in the remote future.

Greater attention to the art of management of water resources is increasingly in prospect, simply because the ease and accessibility of development will decrease while costs increase.

Even in the United States, health officials must return to a daily detailed interest and responsibility for water service, because no other group is likely to make itself responsible for water requirements of communities. His-

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torically, the health officer dominated this area of development, initially for public health reasons and later by virtue of experience in the planning of community water facilities. He must resume this responsibility.

When one turns from the United States, the assessment of water service becomes relatively bleak.

In Central and South America some 100 million people do not have water service at their homes. At the rate at which new water facilities are being built, they will neither meet the enormous backlog of deficiency nor even keep pace with the annual increase in population. Since 1950, for example, an additional 21 million people have been supplied with water, while the population has simultaneously increased by 30 million. If this trend should continue until 1980, probably over 150 million people will lack adequate water services in that year. In these and in many other countries water service not only lags behind population increase, but with each passing year their governments fall further and further behind in installations.

The problem is intensified by the worldwide phenomena of urbanization and industrialization, which subject more and more people to conditions of living far more hazardous than those which prevailed in scattered rural areas. Venezuela is an interesting example of this international trend. In 1943 some 23 percent of the population of this country lived in concentrations of 5,000 inhabitants or more. In 1959 the figure had risen to 62 percent, and by 1980 it undoubtedly will exceed 70 percent. The percentage of population in Venezuela without water facilities, in aggregates of 5,000 or more, has now reached 50. Unless construction is very much greater than is now indicated, the population without water in 1980 may far exceed 50 percent for the urban areas.

Emphasis on development in urban areas is justified only because faster progress is possible and a greater coverage of people may result from a minimum of effort. That one cannot neglect smaller communities and strictly rural areas, because of political and humanitarian reasons, is a foregone conclusion. The magnitude of the water problems in these areas staggers the imagination.

Mexico is a case in point. That country has 24 communities of over 50,000 population; 135 of 10,000 to 50,000, and 824 of 2,500 to 10,000. The number of communities of less than 2,500 is 97,607. Exclusive attention to these small aggregates, as is the case in many countries, undoubtedly will require 75 to 100 years with a net benefit to only a small part of the total population.

Water service in the Near, Middle, and Far East is generally characterized by inadequate quantity, unsatisfactory quality, discontinuity of service, and inaccessibility to many houses, usually those of the poor.

In India the Government has made valiant efforts since 1954 to provide water supply and sanitary facilities. Its progress though significant is still disheartening. In its rural schemes it had provided facilities by 1960 to only a small fraction of the vast total number of villages awaiting service. In urban areas it has provided aid in hundreds of enterprises. The total expenditures, however, for both rural and urban water supply and sanitation projects is pathetically small in comparison with the enormous backlog of necessities and the rapid growth of population.

Implications of Water Availability

For years the sanitarian has emphasized both in thought and in action the high significance of the quality of water for the protection of man. Aside from a few countries, this philosophy has taken the turn of attempting to provide water in tiny quantities, but of good quality, at least at its origin. This action rested upon the sound, but limited, assumption that drops of good water would have high impact upon disease. Many of the hopes in such a philosophy have not materialized. Something more than good quality is essential to the preservation of health. To most fieldworkers it has become equally clear that several liters of water carried from some central point to a place of domiciliary use and storage all too often results in a quality deterioration at the home. The assumption that water of good quality at the source is synonymous with water of good quality at the point of human intake is not borne out by studies of actual household practice.

In addition, it is increasingly clear that disease is related to water quantity nearly as much as it is to water quality. It is an insult to people to preach body cleanliness and a clean home, when they must carry water over long distances and at great sacrifices of time and energy. To ask an individual to maintain total cleanliness, while at the same time failing to provide adequate water quantities, hardly falls within the realm of sound public health education.

Much of the world is plagued by diseases in which water of poor quality plays a significant part. The diarrheal diseases of infants, young children, and adolescents are still the major cause of morbidity and mortality. More than 25 percent of the hospital beds of the world are estimated to be occupied by people ill because of poor water.

In many urban areas in Asia, cholera incidence would be materially reduced by the provision of safe and adequate water to many of the poverty stricken sections which are densely populated and continuously exposed to contaminated waters. In the Calcutta region, generally accepted as one of the major endemic foci of cholera in Asia, life in the bustees is a daily invitation to transmission of cholera and of other waterborne diseases. Significant reduction of these waterborne diseases awaits the provision of an ample quantity of safe water, close to the houses, in order to place cleanliness within the grasp of people.

There is good reason to believe that the persistence of typhoid fever, trachoma, yaws, bilharziasis, and other diseases is significantly related to the nonavailability of safe water in ample quantity.

Dr. C. J. Hackett, the medical officer in charge of venereal diseases and treponematoses of the World Health Organization Headquarters, made the pertinent comment, "It is at least suggestive that one of the main factors reducing yaws prevalence may be more water and more soap.

"A great reduction in the prevalence of yaws not attributable to a mass treatment campaign is usually accompanied by other changes that have contributed to the raising of the standard of living. The more obvious of these are more and better clothing; more bicycles on the roads; more village schools and more secondary school places; more dams, boreholes, and wells available and in use; and more soap—all of which are signs that the community is wealthier. However, village houses may be in no better state of repair, and excreta disposal may still remain a matter of individual action."

This disease, as so many other water "related" diseases, tends to decline as the total standard of living of a community rises.

The renewed emphasis on personal hygiene brings to mind the insistence of the late Professor Winslow on the importance of this factor in the transmission of many communicable diseases.

We have perhaps not yet scratched the surface of the significance of personal hygiene in relation to many of the diseases of modern society. In Louisiana, the transmission of poliomyelitis from vaccinated persons to household contacts was much more frequent in low socioeconomic groups than among those in which hygiene was better (51 percent of household contacts infected in the low socioeconomic group compared with 8 percent in the latter). A similar observation on the poliovirus has been made in the Belgian Congo, where overcrowding and poor hygiene favor the passage of the virus from one child to another. These situations of course, are highly complicated, both in the understanding of the behavior of the virus and in relating environment to these phenomena. In fact, under certain conditions, paradoxes arise between cleanliness, low-level hygiene, and poliomyelitis.

Recently in England, Dr. A. Leslie Banks commented on the relationship of cleanliness to incidence of dermatoses. His article, "Ecology in Relation to Dermatology," presents one of the few attempts to trace the history of skin diseases over the last 100 years or more. His observation is pertinent to a discussion on water-related diseases: "Indeed it is difficult to see how a healthy skin could be maintained in the absence of facilities for cleanliness and well-being." He gives as interesting examples the great decline in England of cases of impetigo and of verminous school children. In 1908 approximately one-half of the girls in urban areas were verminous; in rural areas about one-quarter. In 1951 this figure had dropped to

6 percent of the entire school population. The experience with ringworm was similar. In the early years of the school medical service ringworm was one of its greatest problems. In 1951 only 2,365 school children in England and Wales had ringworm of the scalp. The incidence of scabies in school children had declined from 38,000 cases in 1947 to 4,723 in 1951.

In many of the environmental diseases it is, of course, true that measures other than the provision of water are jointly essential. For many of the intestinal diseases of the world multiple preventive measures would be productive. Mass treatment campaigns with modern atoxic anthelmintic products are indicated. Unfortunately, their success requires repetitive programs. If these are unaccompanied by opportunities for detailed personal cleanliness and broad hygienic living, their repetitive character becomes both permanent and costly.

Many of these considerations are strangely reminiscent of the Mills-Reinke phenomena noted in the early 20th century, when these investigators attributed to improved water service a decline in water-associated, not true waterborne, diseases. Probably the phenomena which they were statistically measuring were those reflecting the opportunities for cleanliness and personal hygiene resulting from ample quantities of safe water.

So far little or no comment has been made on the high significance of water availability in relation to factors other than frank disease. In an era of rapid urbanization and industrialization, both in developed and developing countries, water must play a dominant part. The documentation of the economic impact of water is just being initiated. Such a record is desirable, if for no other reason than to justify the advantages of providing water for expanding populations, whereby vital commerce and industry may progress. Whether privately obtained or publicly developed, most modern industry requires water and in some instances of increasingly higher quality than that provided for human consumption. This trend will be intensified as the complexity and competitive character of manufacturing proceed. Even in a heavy industry such as steelmaking, a high quality of water is increasingly required. This demand has long been met by the synthetic rubber, the synthetic fiber, and the organic chemical industries.

The bare physiological requirements for water have profound significance in space technology, in general military problems, and under the most severe conditions of life in desert areas, but this minimum amount in liters will no longer satisfy the communities with which the practitioner must now deal. Planning water systems for people will not be based on the limited assumptions of the late 19th and early 20th centuries of 6 to 10 gallons per capita per day. Such meager provision ignores the effects and the requirements of urban and industrial life and the necessities of total cleanliness. It is unrealistic for the water needs of 1970 and 1980.

In the United States the requirement for industry and commerce in communities of over 10,000 people is generally more than half of the total water consumption. Furthermore, the amount of water essential for firefighting purposes in many instances dominates the size and cost of American water systems.

Where such a system amply provides for fire protection, the savings in annual fire insurance rates often are equal to the interest and amortization of the bond issue for constructing the facility. This fact is a more impressive argument for the installation of a public water system than is inherent in the prevention of disease. The monetary values are easily demonstrable and hence profoundly convincing to authorities and to citizens.

Too often, in many developing countries, housing projects have remained empty or have not been constructed and agricultural development has been delayed because of serious water deficiency.

These observations might be elaborated tenfold if time were afforded. They all point, however, to the fact that, without water, civilization dies. The late limnologist, Dr. August Thienemann, aptly phrased the theme of this paper in these terms: "Ohne Wasser, Kein Leben; Ohne Wasser, Keine Kultur."

Financial Aspects

If every country in the world is or will be confronted with the necessity of providing water, the problem of how to proceed at once

confronts the practitioner. The provision of water on any community basis, with even the most modest design and construction criteria, requires money. The money inherent in such systems looms large in terms of capital investment. Without burdening this paper with detailed estimates, it may be said that these requirements for money on a worldwide basis will run into many billions of dollars. This one fact staggers the health official, accustomed to annual budgets of relatively small and intelligible amounts.

It is of great importance, therefore, to stress the fact that large amounts of capital money for the purposes discussed here will be relatively small amounts on a per capita basis and still smaller on the basis of annual charges.

No major capital investment would be made in any country for any purpose if the amount were to be repaid in a single year. In functions other than water supply the man on the street is unaware of the investment required. When he enters a bus he does not mentally conjure up the cost of the bus or of the total transport system. When he turns on his electric bulb he is equally unaware of these facts. In community water systems, however, the first item which startles the official, as well as the private individual, is the amount of capital required to construct a system.

Part of this psychological response is due to the practice of constructing systems by central government grants or loans, or international gifts where the amounts are repayable in 5 years or less. These practices have resulted in excessive emphasis upon the initial capital investment, with little or no consideration of repayment on the basis of annual fixed charges over a minimum period of some 20 to 25 years. Persistent emphasis on initial investment will continue as long as central government remains the financial source for increasing numbers of public functions. In one such country 25 years ago, only 3 activities were dominantly supported by the central government; almost 30 functions receive support at present.

One of the first efforts, therefore, should be to develop the fiscal programing on a sound, self-supporting basis, with long-term repayment of capital costs by annual charges against the water user. If and when such principles are adopted, financing of water systems enters the open market with all of the advantages which accrue from such sources of money.

In the United States some 19,000 public water systems have been financed throughout their history on a self-supporting basis. They supply over 125 million people. Without such responsible local financing this result could never have been obtained.

The lessons from this experience of almost 100 years must be adapted to other countries, so universally tied to central government largesse. These adaptations, of course, should be made in the light of the political structures, the cultural history, and the economic practices of the countries concerned. Cultural resistance to a modification of a "free water" concept is frequently suggested as a reason for retarded progress. This is contradictory to the many departures from such principles now successfully operating in almost every country of the world. Almost without exception, these successful departures in utility financing have been due to the high imagination and the courage of the citizens who recognized the obstacles inherent in history and hurdled them by the introduction of new practical and flexible schemes of finance.

Removal of Sewage Nutrients by Algae

R. H. BOGAN, Sc.D.

EXCESSIVE enrichment, or eutrophication, of receiving waters by nutrient-rich wastes is emerging as a major water pollution problem. For some time it has been recognized that ordinary domestic sewage is a rich source of the nutrients required by phytoplankton. Inorganic nitrogen and phosphorus are the most important of these nutrients, and it is on the supply of these that the degree of eutrophication depends.

From time to time, interest has developed in finding some method of waste treatment which would remove the offending fertilizing elements from sewage before it is discharged into the receiving water. Limnological investigations indicate that removal of phosphorus offers a practical and effective way of controlling algal growths in most natural waters (*1*). Phosphorus may be removed by biological or chemical means. Both approaches aim at the conversion of soluble inorganic phosphorus into recoverable insoluble matter. Of the two, the chemical method has received greater attention, and several promising but costly means of chemical coagulation have been proposed. Little has been done with biological treatment.

Dr. Bogan is associate professor in the civil engineering department of the University of Washington at Seattle. *This article is based on a paper presented at a seminar on Algae and Metropolitan Wastes held at the Sanitary Engineering Center, Public Health Service, Cincinnati, Ohio, April 27–29, 1960.*

Initial phases of the work, including the laboratory pilot-plant studies, were supported by the University of Washington Engineering Experiment Station. The City of Seattle provided funds for construction of the field-plant pilot plant.

The usefulness of algae as a means of removing nutrients from domestic sewage is examined in this paper. This aspect of algal activity appears to have received relatively little attention; hence, much of what follows is based on research carried out at the University of Washington from 1956 to 1959. Wherever possible, pertinent data reported by others have been drawn upon.

Theoretical Concepts

The concept which concerns the removal of nutrients from wastes by biological means can hardly be considered new. In any actively growing biological system nutrient materials are continually extracted from the environment through conversion to cell mass. The rate of nutrient removal, other factors being equal, is based on the rate of cell synthesis, while the amount of nutrient reduction is determined by cell mass composition and the mineral content of the medium.

Many excellent reports have appeared in the literature dealing with algal behavior in oxidation ponds and raw sewage lagoons (*2–5*) but, unfortunately, very few data have been reported regarding nutrient reductions achieved in such processes. Attention to the role of algae in sewage treatment has centered largely on the use of photosynthetic oxygen production. Available information indicates phosphorus reductions ranging from 10 to 90 percent or more, with performance erratic and unpredictable. There has been considerable difficulty in harvesting algal cell tissue, which, coupled with the slow rate of growth, probably accounts for some of the wide fluctuations noted in the mineral composition of lagoon effluents.

Rate of phosphorus removal in a biological treatment process is dependent upon the growth rate of the biological system being employed. The amount of phosphorus removed is determined largely by the composition of the microorganisms and by the composition of the waste. Cell tissue composition for activated sludge and for common fresh-water algae is shown in table 1. Growth rates commonly reported for algae, protozoa, and bacteria are shown below. In this comparison of growth rates, k (days^{-1}) is based on $N_t = N_o e^{kt} (t = 1 \text{ day})$.

Organism	*Growth rate*
Algae	0.20 to 2.0
Protozoa	1.0 to 4.0
Bacteria	2.0 to 60

Examination of the data presented in table 1 indicates that assimilation of 1 mg. per liter of phosphorus would be accompanied by a metabolism of 25 to 50 mg. or more per liter of carbon and 2 to 12 mg. per liter of nitrogen. Theoretical values of daily phosphate removal are shown in figure 1 for several concentrations of cell tissue having growth rates comparable to those commonly reported for algae.

Ordinary domestic sewage does not provide a balanced diet; both carbon and nitrogen are deficient in relation to the amount of phosphorus normally present. In activated sludge, organic carbon is usually limiting. Agricultural grade ammonia nitrogen could be made to serve as an economical source of supplemental nitrogen, but in most situations the cost of supplying adequate organic carbon would be prohibitive.

Algae do not suffer from the same dietary restrictions as bacterial complexes such as activated sludge. Adequate amounts of carbon are normally available in the form of alkalinity and atmospheric CO_2. While the inorganic nitrogen supply may still be limiting, there is evidence that atmospheric nitrogen fixation might be made to serve as a significant source of nitrogen in large-scale algal cultures (*1*). In terms of nutritional requirements, algae appear to offer the most easily exploited biological system for extracting phosphorus from domestic sewage.

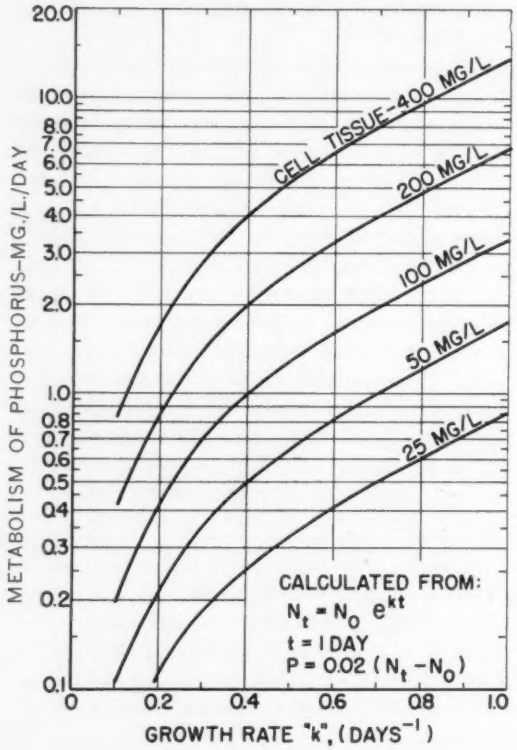
Significant amounts of phosphorus should of course be removed during conventional biological treatment of sewage. Based on a carbon to phosphorus ratio of 100:1 and a biochemical

Table 1. Percent dry weight of components of activated sludge and common fresh-water algae

Waste	Biological system	
	Activated sludge [1]	Algae [2]
Carbon	41–53	49–70
Nitrogen	8–12	1. 4–11
Phosphorus	0. 7–2. 2	0. 7–2. 0

[1] See references 7 and 8.
[2] See reference 2, chapter 8.

Figure 1. Theoretical relationship between cell-tissue concentration, growth rate, and metabolic conversion of phosphorus by algae



NOTE: Light intensity determines cell-tissue concentration: k is regulated by temperature, diet, and species. In the Seattle area algal concentration ranged from 25 to 50 mg. per liter in 4-foot deep lagoons. The mean k was 0.30 days.

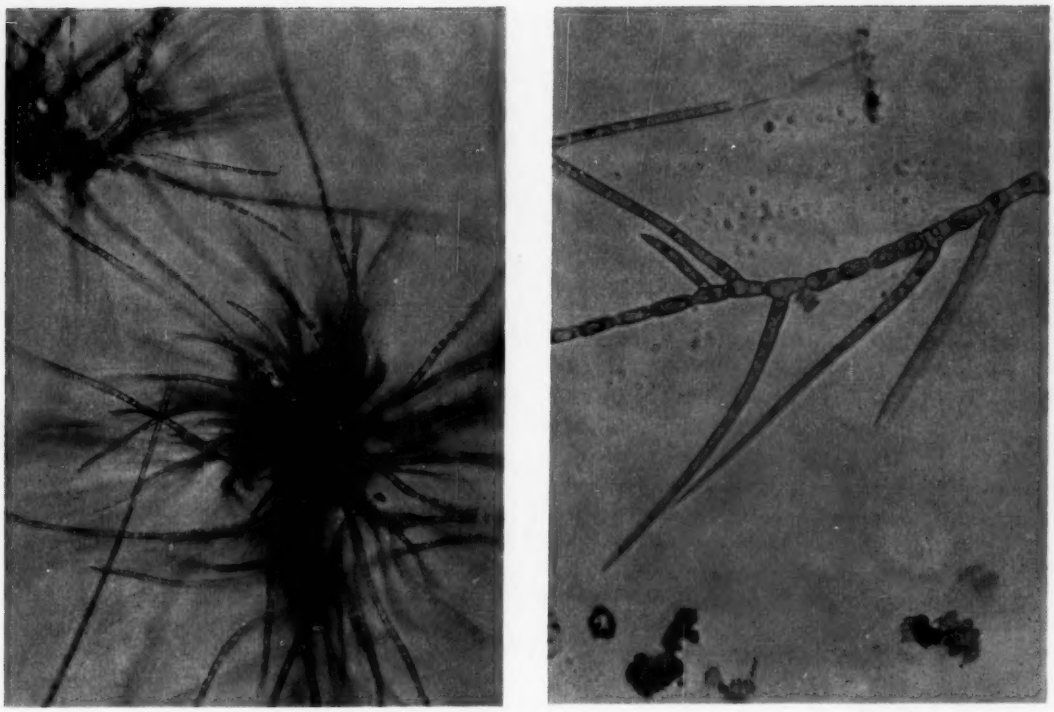


Figure 2. Photomicrographs of Stigeoclonium stagnatile: left, floclike colonies developed in aerated cultures, 185 ×; right, individual organisms, 445 ×

oxygen demand of settled raw sewage in the range of 100 to 200 mg. per liter, it becomes obvious that phosphorus reductions during the course of biological sewage treatment would on the average be limited to about 1 to 2 mg. per liter. Owen (*6*), in an investigation of sewage treatment plants in Minnesota, found that the average phosphorus removal ranged from 2 percent for primary treatment plants to 23 percent for plants employing biological treatment; this range was equivalent to approximately 1 to 2 mg. per liter of phosphorus. Analysis of effluents of biological sewage treatment plants in the Seattle area disclosed a reduction ranging from 15 to 40 percent, equivalent to 0.8 to 2.0 mg. per liter of phosphorus.

The most direct method of using algae for recovering nutrients from sewage would be to add the algae to the sewage in oxidation ponds. With such an arrangement, sewage would be continually mixed with actively growing algae and the nutrients would gradually be converted to new cell tissue. Algae could be removed for re-use or treated as waste, according to need. Experience indicates that the principal problem would be harvesting the algae.

A number of methods of harvesting algae from oxidation ponds have been investigated. All have been found wanting, usually in efficiency, often in cost. From the standpoint of all-around performance and economy, the most promising operation for separation of algae from sewage would appear to be some type of screening.

Screening results obviously would be related to the nature of the algal culture. However, if a readily recovered algal species could be established, then, through the simple mechanism of recovery and re-use, this species might be made to predominate. Other things being equal, the process would tend to contain the most readily utilized algae.

The ideal organism appears to be a large, rapidly growing filamentous alga. There is little evidence that desirable filamentous species normally grow in oxidation ponds or sewage

lagoons, but this does not preclude the possibility of their being cultivated under such conditions. Failure of filamentous species to constitute a significant part of the algae population of most oxidation ponds may be due to the fact that they are relatively slow growers and tend to be overgrown by rapidly multiplying species, such as *Chlorella* and *Scenedesmus*.

Laboratory and Pilot Plant Results

Early experimental efforts at the University of Washington to remove excessive amounts of nutrients from sewage were influenced by the principle of establishing and utilizing unique algal species. A large part of this investigation was concerned with the mechanisms by which algae removed phosphorus from solution. Attention subsequently centered upon the development and evaluation of a process of high-rate phosphorus removal. The following is a brief summary of some of the more significant findings of this research on available algae, the mechanism of phosphorus removal, the physical-chemical behavior of orthophosphates ($PO_4^{\equiv}$), photosynthetic pH adjustment, and cell tissue recovery.

Table 2. Effect of temperature and culture media on growth rate of Stigeoclonium stagnatile [1]

Temperature (degrees centigrade)	Growth rate [2]		
	Synthetic sewage employing NO_3–N	Synthetic sewage employing NH_3–N	Secondary sewage treatment plant effluent
10	0. 165	0. 140	0. 170
15	. 188	. 179	. 215
20	. 252	. 131	[3] . 131

[1] pH varied from 8.3 to 9.5; illumination was at 400 foot-candles.
[2] k (days^{-1}); k computed from $N_t = N_o e^{kt}$.
[3] *Scenedesmus* appeared and began to predominate after approximately 15 days.

Table 3. Phosphorus and nitrogen content of Stigeoclonium stagnatile harvested from various culture media [1]

Constituent	Synthetic sewage		Secondary sewage treatment plant effluent	½ sewage treatment plant effluent ½ NO_3–N synthetic sewage
	NO_3–N	NH_3–N		
N	5. 71	6. 59	6. 52	6. 00
P	2. 16	1. 81	1. 89	3. 07
N/P	2. 64	3. 63	3. 44	2. 89

[1] Expressed as percent dry-cell weight. Values reported represent an average of several determinations.

Several common fresh-water algae were grown in the laboratory on mixtures of lake water and raw and treated sewage. However, except for *Chlorella* and *Scenedesmus*, most species gradually died out after a brief period of active growth. A large filamentous alga, subsequently identified as *Stigeoclonium stagnatile*, was recovered from the rock of a biological filter in the area and successfully cultured. This alga, when grown under aeration, developed into settleable floc particles resembling activated sludge (fig. 2). The alga's growth characteristics and nitrogen and phosphorus content are shown in tables 2 and 3.

It was expected that phosphorus removal would follow a pattern predicted by the cell-tissue composition and growth rate (fig. 1). Contrary to expectations, orthophosphate residuals in batch-fed cultures decreased at a rate considerably in excess of that predicted by biological uptake. Response to repeated heavy phosphate doses was most interesting; in general 80 to 90 percent of the phosphate added was removed from solution within 2 hours. Obviously, more than metabolic uptake was involved. Examination of culture characteristics disclosed that phosphorus removal was related to pH. It thus appeared that coagulation and adsorption may have been significant.

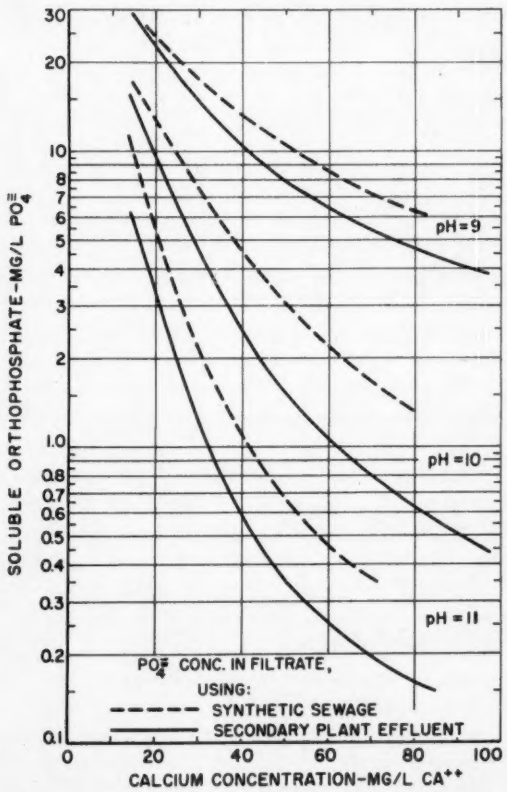
At moderately high pH levels, generally in the range of 9.5 to 10.0, large amounts of phosphorus were extracted rapidly from solution without the use or need of auxiliary chemicals. At lower pH levels, the rate of phosphorus removal should, of course, be determined largely by algal growth rate. This hypothesis was subsequently tested in the laboratory and in the field. At pH levels of 9.5 and above, field cultures exhibited phosphate reductions comparable to those observed in laboratory-batch and pilot-plant studies.

Under suitable conditions, orthophosphate

may combine with a number of substances commonly present in sewage to form relatively insoluble complexes. Calcium ion concentration and pH were found to be the principal controlling factors in determining $PO_4^{\equiv}$ solubility (fig. 3). Ammonia, iron, and magnesium in the amounts generally encountered in domestic sewage were not found to exercise any discernible effect on phosphate solubility.

In a study of the role of algae in adjusting pH, such factors as temperature, cell-tissue concentration, composition of culture media, and the degree of alkalinity were expected to influence the rate of photosynthetic pH adjustment. Light intensity was found to be the principal rate-controlling factor. Photosynthetic pH response under carefully controlled laboratory conditions and under field conditions is shown in figure 4 and table 4. Where light was not limiting, pH response followed a pattern such as that shown in figure 4. Under field conditions, light intensity became limiting and the rate of change of pH was markedly reduced.

Figure 3. Influence of pH and calcium concentration orthophosphate solubility



NOTE: Calcium ion concentration and pH adjusted by means of $CaCl_2$, $Ca(OH)_2$, and NaOH. $PO_4^{\equiv}$ residuals for synthetic and treated sewages based on filtered supernatant.

Judged solely on the basis of rate of pH adjustment, minimum light-intensity requirements appear to lie in the vicinity of 100 to 200 foot-candles. Where such light intensities are possible, the pH of raw and treated sewage may be photosynthetically increased to 9.0 and above in 4 to 12 hours.

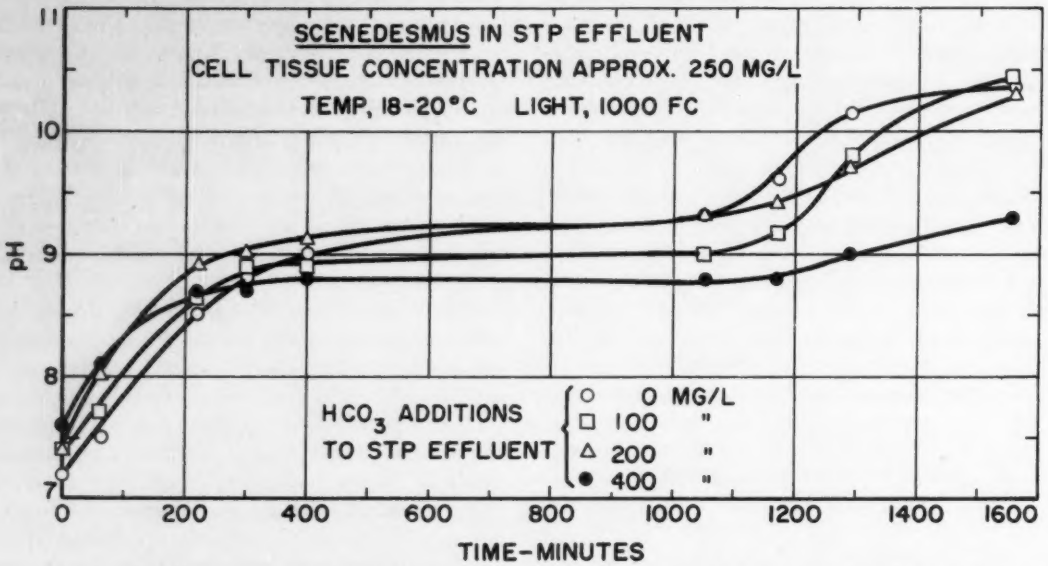
When it was found that *S. stagnatile* could be effectively recovered by sedimentation, employment of a screen for cell-tissue recovery was abandoned. Repeated use of a *Stigeoclonium* culture during successive batch feedings or during cell-tissue recycling in pilot-plant operation resulted in marked improvement in settling characteristics. It thus appears that adsorption of insoluble calcium phosphate salts by the algae caused coagulation of cell tissue, thereby increasing its rate of subsidence.

During pilot-plant studies, the *Stigeoclonium* culture became contaminated with *Chlorella* and *Scenedesmus*. At temperatures above 20° C. *Chlorella* and *Scenedesmus* tended to predominate; *Stigeoclonium* was simply overgrown. This gave rise to some serious misgivings until it was observed that culture settling characteristics varied little with species because of the coagulation effect of the insoluble phosphate salts produced at high pH levels. This is most interesting, for it implies that the algae in most oxidation ponds might be effectively recovered by sedimentation if they are first permitted to increase pH levels above approximately 9.5 before recovery is attempted.

Discussion

Algae are capable of removing phosphorus from solution both by metabolic uptake and by chemical coagulation and adsorption. Adsorption and coagulation appear to play the major role in rapid removal of large concentrations of phosphorus. The relative significance of biological uptake depends, of course, on the algal growth rate and environmental conditions and on the time available for growth. In either

Figure 4. Influence of HCO_3 concentration on photosynthetic pH shift



NOTE: At light intensities above 200 foot-candles, *Scenedesmus*, *Chlorella*, and *Stigeoclonium* caused a rapid increase in the pH of raw and treated sewages. Alkalinity in amounts generally encountered in most sewages had little effect on pH response.

Table 4. Photosynthetic pH changes in lagoon cells, autumn 1958

Lagoon cells[1] and sampling conditions	Time (days)							
	1	2	3	5	7	10	12	15
Lagoon cell:								
1[2]	7.7	7.6	8.4	8.7	8.5	9.4	9.5	10.1.
2[3]	8.0	7.7	8.4	8.8	8.9	9.2	9.2	9.6.
3[4]	8.1	8.0	8.5	9.1	9.3	9.7	9.7	10.4.
4[5]	8.1	7.5	8.2	10.4				
Sampling time	1:30 p.m.	11 a.m.	11 a.m.	11:30 a.m.	10:30 a.m.	3 p.m.	11:30 a.m.	12 m.
Weather	Cloudy	Cloudy	Partly cloudy	Rain	Sunny	Partly cloudy	Sunny	Sunny.
Temperature, degrees centigrade.			14		12	11	10	11.
Suspension solids, mg. per liter.		28	33	36	36	62	62	70.

[1] All lagoon cells filled with second-treatment plant effluent and seeded with equal volume of algal culture.
[2] Intermittent aeration plus artificial illumination (400 foot-candles) in afternoon.
[3] Intermittent aeration; no artificial illumination.
[4] No aeration; no illumination.
[5] Intermittent aeration; air off after day 6.

case, it is the photosynthetic activity of the algae which governs the rate of removal.

Laboratory pilot-plant studies employing an illuminated contact unit followed by sedimentation have demonstrated that a process with a high rate of continuous flow is functionally feasible when light is not limiting. Orthophosphate concentrations can be reduced to less than 1 mg. per liter within 6 to 12 hours. This is equivalent to a 90 to 95 percent reduction in the phosphorus content of most sewage. Residual phosphate concentrations of about 3 to 5 mg. per liter were achieved with periods of contact as brief as 2 to 4 hours.

While a high treatment rate with the algal process appears to be functionally sound, economic considerations restrict the use of algae to the more leisurely conditions prevailing in oxidation ponds and sewage lagoons. Process costs are related to the cost of pH adjustment, which is a function of light requirements and the time required for detention. Where artificial illumination is used, power requirements and hence cost can be computed from a knowledge of lamp performance and the rate of light attenuation in the algal culture. In figure 5, cost of pH adjustment employing artificial and natural illumination is compared with the cost of pH adjustment by lime alone. Lime requirements were computed from titration curves of a number of treated sewages in the Seattle area. Economic considerations appear to preclude the use of artificial illumination.

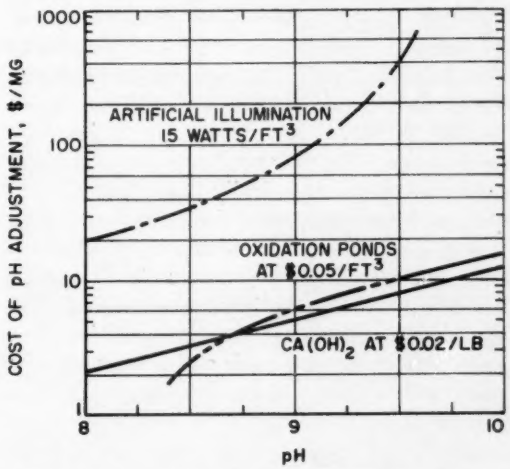
Because of a high rate of light attenuation, it is exceedingly difficult to maintain adequate illumination of large-scale cultures. Theoretical considerations based on the Beer-Lambert law indicate that ordinarily it would not be possible to maintain light intensities above 100 foot-candles by natural or artificial means in depths much greater than 1 foot. Current practice is to construct oxidation ponds and lagoons with depths ranging from 3 to 5 feet.

As a practical matter, where thorough mixing occurs, the effect of employing depths greater than the depth involved in photosynthesis is roughly equivalent to illuminating the entire culture at a proportionately lesser intensity. The net photosynthetic response is thus reduced, and a longer contact time must be provided to achieve a given degree of pH adjustment. For example, it was found that 12 hours of contact time at 100 foot-candles was approximately equivalent to 10 to 12 days of lagoon retention time under field conditions prevailing in the Seattle area during the fall of the year.

Theoretically, an oxidation pond should be capable of very high efficiency in phosphorus removal. In order to realize this potential, active photosynthesis or high pH conditions, or both, must prevail for some time prior to discharge of sewage into the receiving water. Where biological fixation is the principal mode of phosphorus removal, the efficiency of the method will depend on detention time, growth rate, and cell-tissue concentration.

During field pilot-plant studies, algal concentrations in lagoon units with a depth of 3 to 4 feet varied from 25 to 50 mg. per liter. Average growth rate was equivalent to a rate of growth of 0.30 day^{-1}. Thus, in order biologically to extract 5 mg. per liter of phosphorus (equivalent to 80 to 90 percent reduction for most sewage), a lagoon retention time of

Figure 5. Economic comparison of various methods of adjusting pH



NOTE: Costs of electrical energy were based on 1 cent per kilowatt-hour; power needs, on high-voltage fluorescent elements and a culture extinction coefficient of 2×10^{-3} $cm.^2/mg.$; oxidation pond costs, on construction costs of 5 cents per cubic foot, a useful life of 20 years, and a liquid depth of 4 feet; and lime requirements, on titration curves for sewage in the Seattle area. Mechanical equipment costs were not considered.

14 to 28 days would be required. Theoretical retention time requirements for any other set of circumstances can be calculated from the data presented in figure 1. These considerations suggest that pond volume in excess of that employed in most oxidation ponds may be necessary where a high degree of phosphorus removal is an objective.

Summary and Conclusions

The principle of employing algae as a means of removing phosphorus from sewage was studied in the laboratory and, on a pilot-plant scale, in the field. A process was developed in the laboratory whereby soluble phosphate reductions equivalent to 90 percent or more were achieved with contact times as brief as 6 to 12 hours. The process subsequently was studied in the field along with the behavior of conventional sewage lagoons. Among the findings were:

1. In the presence of adequate amounts of light, it is possible to realize rapid biological extraction of phosphates. Minimum light requirements appear to be in the vicinity of 100 to 200 foot-candles.

2. Under normal field conditions, adequate light intensities seldom prevail in algal cultures at depths much in excess of 1 foot. The use of deeper ponds, as is common practice today, serves in effect to decrease net illumination roughly in proportion to the ratio of light and dark volumes. Photosynthetic reaction times therefore must be markedly increased.

3. Adsorption and coagulation appear to play the major role in rapid removal of large amounts of phosphate. Metabolic conversion is the principal mechanism for removal of phosphate under the more leisurely conditions prevailing in oxidation ponds and sewage lagoons. In lagoons efficiency of phosphate removal is proportionate to detention time, other factors being equal.

4. Three algae, *Chlorella*, *Scenedesmus*, and *Stigeoclonium*, were grown in raw and treated sewage. Repeated re-use of these algae generally improved subsidence properties without noticeably impairing photosynthetic response. Settleability appeared to be influenced by the formation of insoluble phosphates at elevated pH. It appears that the photosynthetic pH shift may be employed as a means of enhancing the recovery of algae by sedimentation.

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REPORT

by the Committee on Fringe Area Sanitation Problems of the American Public Health Association, October 19–23, 1959, Atlantic City, N.J.

Fringe Area Sanitation

Reflecting the changing emphasis in environmental health, the American Public Health Association in 1958 organized the Committee on Fringe Area Sanitation Problems to replace its Rural Sanitation Committee. In the first year, the new committee drew up plans for future activities. The preamble to its report (see page 310) set forth an outline of preventive action and responsibility which still forms the basis for the committee's assignments.

As indicated in the preamble, the health department plays a dual role, stimulating activities for which it does not have technical expertness or primary responsibility and taking the lead in those for which it does. For example, it should encourage adoption of a comprehensive plan, a regional water and sewerage plan, and a building code. It should actually formulate, have adopted, and enforce a subdivision control law, a minimum standards housing ordinance, a sanitary code, air and stream pollution abatement laws, and radiation protection legislation, as well as rules and regulations for the more conventional environmental health activities.

The 1959 committee proceeded to explore and define the basic underlying fringe area sanitation problems: governmental jurisdiction, legislation, subdivision standards, planning and zoning, financing, and population. The results of this exploration, prepared by the committee, are presented here. The committee was not asked for solutions and it has suggested none, but it hopes this report may serve as a basis for solutions.

Financing

Financing community sanitation facilities for fringe areas, within the framework of sound planning and economic and engineering feasibility, is said to be difficult in some situations because:

1. An adequate tax base for the financing of community facilities for fringe areas often does not exist until after a sufficient number of dwellings are constructed and occupied. Scattered groups of houses cost more to serve than the tax (or revenue) they produce for such services.
2. A developer frequently does not have sufficient funds to finance sanitation facilities in spite of anticipated revenue, or would rather spend money on improvements that can be seen.
3. Lending institutions refuse to lend money for subdivision water and sewerage systems as there is little or no resale value in these utilities, particularly if the developer or builder fails to complete his project.
4. Many developers are reluctant to assume the full financial risk involved in providing water and sewer lines for a new subdivision as they are not sure that they will be able to sell a sufficient number of dwellings or lots to pay for the utilities and realize a profit.
5. Some developers will sell only lots to avoid risks of capital outlay. Any sanitation problems resulting are shouldered by the individual deciding to build a home and eventually by the community.

Joseph A. Salvato, M.C.E., director of the division of environmental hygiene, Rensselaer County Department of Health, Troy, N.Y., was chairman of the 1959 committee. Other members were Irving Grossman, M.S.E., Herbert H. Hasson, Emanuel H. Pearl, M.S., Joseph W. Price, M.P.H., Ivan F. Shull, B.S.C.E., M.P.H., and Floyd B. Taylor, M.P.H. David B. Lee, M.S., and James R. Simpson, M.S., were committee advisers.

6. The actual cost of sanitary facilities, such as sewerage and treatment works, may be deliberately obscured by the developer for competitive and other reasons.

7. The local municipality usually does not extend water and sewer lines to serve proposed new subdivisions beyond corporate limits. Such extension would be considered an improper use of public funds for land speculation, as the community (taxpayer) stands to pay higher taxes if the project fails but cannot possibly benefit if the project is successful.

8. There is sometimes a lack of understanding or reasonable consistency as to what part of the cost the developer pays, for providing sanitation facilities to improve raw land in excess of his normal needs, and what part can be properly charged to the whole community. Regulations for prorating the cost against the surrounding areas to be benefited may not be available.

9. The fringe areas may not be within the service area of an existing governmental unit, district, or authority which has an adequate

Preventive Action and Responsibility

The fringe areas of today are the communities of tomorrow. To reduce the anticipated environmental problems of the future, health department sanitary engineers must look beyond water and sewerage. To obtain and maintain a healthful living environment, and incidentally, solve very important water and sewerage fringe area problems, we must cooperate with and enlist the aid of other agencies and people who have perhaps an equal interest in our objective.

The prevention and solution of environmental problems is hampered by the multiplicity of local governments and the strong desire for local autonomy. But community growth causes reactions which extend beyond fixed boundaries and are therefore beyond the control of individual municipalities. The basic elements, to promote a more healthful living environment, which affect fringe area sanitation, as well as other phases of environmental sanitation, include:

a. A regional or county planning board, with health department representation, and a comprehensive plan. The responsibility of the planning board should include regional or drainage area planning for sewerage, water supply, and subdivision control, as well as drainage, transportation facilities, land use, etc.

b. Full-time local health services, including an adequate professional sanitary engineering and sanitarian staff and a comprehensive modern sanitary code.

c. Adequate legislation to permit formation, financing, and construction of regional water and sewerage services.

d. A State and county or regional subdivision control law designed to protect the public health, prevent installation of substandard water and sewerage facilities, and enforced by an adequate, qualified staff.

e. A sound building code, plumbing code, and zoning ordinance with competent direction and strict control over variances. County or regional administration is advised where practicable.

f. Delineation of areas suitable for development with public sewers and water supply, and with individual drilled wells and/or septic tank systems.

g. An urban and suburban renewal program including planning, clearance, housing rehabilitation and conservation, and redevelopment of the "infected" urban and fringe areas based on the comprehensive plan.

h. A minimum standards housing ordinance directed to the external living environment as well as dwelling occupancy, supplied facilities, and maintenance, adapted from the APHA Proposed Housing Ordinance.

In order to secure these basic elements for a healthful living environment, it is necessary to utilize fully the combinations indicated by local conditions, and the talents and resources available in a properly staffed health department. It is the duty of all health department personnel to encourage and stimulate action in each area of activity and need.

—Preamble to the report by the 1958 Committee on Fringe Area Sanitation Problems of the American Public Health Association.

existing or potential tax base to support the extension of water and sewer lines.

10. Where fringe areas are within a service area with an adequate tax base, bonding or tax limitations may hinder or prevent financing of sanitation facilities, unless the developer pays the major cost.

11. The construction of new schools to serve the increasing population and the construction of new central schools to replace existing inadequate small schools have captured a large share of the tax dollar, thereby making more difficult the financing of other essential community services.

12. The common practice of placing revenue from a public water supply into the "general fund" makes it difficult for a water department to plan for and make extensions or improvements.

13. Water rates in some communities are unrealistically low, thereby discouraging extensions under present-day costs.

Government

Recognition of the existing governmental relationships on a Federal, State, and local level, and the administration provided, can help explain the existing and emerging fringe area sanitation problems.

1. Most local governments have not adjusted their administrative machinery to cope with the new and changing needs of their people.

2. Many State and local governments have failed to provide the leadership and enabling legislation to make it possible for local governments to alter their structure to cope more adequately with the new and changing needs of their people.

3. Sectional jealousies discourage cooperation and the often less expensive regional or cooperative solutions to sanitation problems.

4. Fringe area sanitation problems are part of a larger total complex problem, the solution of which is dependent on informed political action.

5. There is no one form of government which can be applied as a panacea in solving all sanitation problems.

6. Although the sanitary engineer in public health is not usually in a position to shape political circumstances, he should be thoroughly acquainted with the governmental phases affecting his work at whatever level he operates in order to know how to work through existing governmental arrangements.

7. Failure to provide (*a*) full-time, adequately staffed local health services, including competent sanitary engineering direction of the environmental sanitation services, and (*b*) a modern sanitary code aids and abets the development of fringe area sanitation problems. This makes prevention, cure, and control more difficult and distant.

8. Resources and leadership from the Federal, State, and local governments, where available, should be fully utilized to accomplish cooperatively mutual objectives.

9. Continuing governmental study of fringe area, urban, and metropolitan problems and periodic suggestions for new and revised legislation are needed. Expert governmental consulting advice should be available to municipalities needing help to prevent and solve municipal problems caused by population growth, and these services should be used by more municipalities.

10. Although the geographic dividing line between corporate limits of a city and a suburb is clear on a map, it is often indistinguishable to the casual observer passing through.

Legislation

There is usually a lag between recognition of the existence, or emergence, of problems and the adoption of legislation to control and prevent problems. Some reasons for and consequences of this phenomenon are given below.

1. Political expediency can hamper adoption or enforcement of control legislation to solve and prevent fringe area sanitation and other metropolitan problems.

2. Public apathy supports political expediency.

3. Political courage and political leadership are scarce commodities. The courageous political leader is more often a dead statistic; less frequently, a surviving hero.

4. Inadequacy or lack of subdivision regulations, zoning regulations, building codes, and plumbing codes compounds the fringe area sanitation problems.

5. The sanitary engineer in public health

may often be influential in obtaining passage of legislation, and he should be familiar with all auxiliary legislation affecting his field, such as subdivision regulations, zoning acts, and building codes.

6. Prohibiting operation of sewerage systems and sewage treatment works by corporations in some States has hampered solution of the sewage disposal problem.

7. In some States legislation is needed to consolidate and establish multipurpose metropolitan districts, federation of local units, and county districts.

Subdivision Regulation

In some cases the lack of effective subdivision regulations has resulted in poorly laid out subdivisions with overflowing septic tank leaching systems and polluted private wells and inadequately planned and operated community facilities, such as water and sewerage systems, which contribute to premature neighborhood deterioration.

1. Many communities have failed to control subdivisions through planning, zoning, health, and building regulations.

2. Many health departments have failed in a traditional area of responsibility by default.

3. Dwellings have been built in subdivisions where the soil is unsuitable for sewage disposal.

4. Large developments have been built with individual wells and sewage disposal systems in place of community sewerage and water systems because of the lack of predevelopment surveys and investigations and sanitary engineering interpretation of basic data.

5. A model subdivision regulation is needed which recognizes the sanitary engineering factors that can prevent the common sewage disposal and water supply fringe area sanitation and related problems.

6. The design of sewerage systems and treatment plants to serve subdivisions, without regard to future regional or area sewerage system trunkline invert elevations, makes integration of existing small treatment plants and sewerage systems difficult and expensive.

7. Water systems for subdivisions usually do not provide for future expansion, extensions, peak hourly flows, or fire protection.

8. Local health departments could benefit by the use of scientific information on soils. Federal agencies could help make available better and more usable soil information.

9. Health departments could give more assistance to the developer in showing the economic, engineering, and governmental feasibility of community sewerage.

Planning and Zoning

Lack of comprehensive planning and zoning encourages chaotic community growth, thereby making more difficult and expensive the solution of fringe area water supply, sewerage, and other community problems.

1. Small lots or large lots and poor soil make sewage overflow a foregone conclusion when public sewers are not available.

2. Unsuitable living areas set the stage for rapid property devaluation and substandard housing.

3. Residential construction has taken place with septic tank systems and private wells in places where public water and sewerage should have been required.

4. Permitting smaller lots, and a larger number, with public water supply and sewerage, and large lots (1.0 to 2.5 acres) with private wells and septic tank systems has not been fully exploited to help control the fringe area sanitation problems.

5. Although Federal assistance is available to communities under 25,000 population and to metropolitan areas for comprehensive planning to the extent of 50 percent of the cost, a relatively small number of communities have taken advantage of the outright grant.

6. More communities should take advantage of interest-free loans from the Community Facilities Administration of the Housing and Home Finance Agency for planning specific public works projects including the cost of engineering and architectural surveys, designs, plans, estimates, working drawings, specifications, and other data essential to construction, such as water supply and sewerage, before such facilities become critical. Repayment is not required until construction is undertaken.

7. Too many communities are faced with almost catastrophic expenses for the extension or rehabilitation of community facilities because of failure to make planned capital improve-

ments gradually on a year-to-year basis in accordance with a long-range plan.

8. "Ribbon" development and "spatter" subdivision development, with no regard to the availability of public water supply and sewerage, compound the difficulty of achieving orderly and economic solution to the fringe area sanitation problems.

9. New and improved highways encourage "ribbon" and "spatter" developments. Greater cooperation is needed between highway planners and community planners.

Population

The population of the United States continues to increase and migrate to the suburbs. The population pressures are not "passing fancies" but continuing dynamic forces to be seriously considered. Some pertinent observations follow.

1. The census estimates in many instances have proved to be conservative.

2. The 1950 census shows that the population of metropolitan areas increased 22 percent between 1940 and 1950, whereas the other areas increased by only 6 percent. However, the population increase in metropolitan areas took place in the urban fringe areas not necessarily within any single existing governmental service area.

3. A census study of civilian population of the United States—March 1950 and April 1956—showed that within the standard metropolitan areas the outlying parts grew about six times as rapidly as the central cities, or 29.3 percent as against 4.7 percent (1956 population, 164,308,000). More than half the increase in the population of metropolitan areas (55.8 percent) occurred in territory classified as rural in the 1950 census. Undoubtedly much of this increase was in newly developed suburban areas which will be classified as urban in the 1960 census. The rural population increased from approximately 54 million in 1950 to 61 million in 1956.

4. The large population growth in many areas has caught municipalities unprepared to provide essential services.

5. Population has increased in many areas formerly rural without corresponding adjustment in local governmental administration to cope with and control the resulting problems.

6. The line of demarcation between the urban suburb in a metropolitan area and the rural area is fluid.

7. Many areas classified as rural in the 1950 census are already eligible for inclusion in a metropolitan area.

8. The highest percentage population increase is still taking place in the rural-suburban belt.

9. "The rural-nonfarm population includes all persons living outside urban areas who do not live on farms. In 1940 and earlier, persons living in the suburbs of cities constituted a large proportion of the rural-nonfarm population. The effect of the new urban-rural definition has been to change the classification of a considerable number of such persons to urban. The rural-nonfarm population is, therefore, somewhat more homogeneous than under the old definition. It still comprises, however, persons living in a variety of residences such as isolated nonfarm homes in the open country, villages and hamlets of fewer than 2,500 inhabitants. and some of the fringe areas surrounding the smaller incorporated places." (U.S. census of population: 1950, Vol. II, Characteristics of the population, Part 1, United States summary, p. 35.) This change in definition, although convenient for certain purposes, tends to obscure the magnitude of the fringe area sanitation problem and the number of people affected.

10. The 1950 census shows that 54,229,675 people (36 percent) live in rural areas. Also, 27,218,538 people reside in urban areas of 2,500 or more population located outside the 157 urbanized areas, which have a population of 69,249,148. Therefore, the total number of people outside the 157 urbanized areas in 1950 was 81,448,213, or 54 percent of the total population.

11. The population has been expanding at an increasing rate, as noted by the following figures:

Year	*Total U.S. population*	*Average annual increase*	
		Number	*Percent*
1930	122,775,000	----	----
1940	131,669,000	889,400	0.72
1950	150,697,000	1,902,280	1.44
1958	[1] 175,000,000	3,037,800	2.01

[1] December estimate.

12. A "wave" of new families, that is, marriages from the "baby boom" of the middle 1940's, can be expected beginning in the middle 1960's, with resultant increased demands for housing and community services. Each succeeding generation "wave" promises to grow even larger.

13. The migrating population—from one region to another, from farm to city, from city to suburb—compounds the problems in certain areas.

Other

The desire for a "home in the country," the changing pattern of work and living, increased leisure, larger families, higher taxes, demand for more governmental services, and many other factors have led to interesting situations. Some of these are:

1. Rural areas become part of a "standard metropolitan area" before the public realizes what has happened.

2. When people begin to demand the services normally considered "city services," it finally and reluctantly dawns upon them that they are part of a metropolitan area. It may then take a generation for these same people to accept the responsibilities that accompany urbanization.

3. Until the citizens actually understand what is happening, and the need for a regional or metropolitan administrative organization, and are willing to give up some of their privileges, little will be accomplished economically to solve existing problems and eliminate future problems. In other words, the welfare of the community must in some instances supersede that of the individual to assure his security.

4. The people, the elected officials, and all public health workers must be educated to recognize the fringe area sanitation problem and to stimulate corrective community action.

5. Some public health associations, as well as individuals, have been unwitting accomplices to the fringe area sanitation problem by failing to strongly recommend sanitary engineering direction of environmental health programs. The number of sanitary engineers, sanitarians, and sanitary inspectors or technicians depends not only on population but also on population changes, comprehensiveness of the environmental health program in effect, and specific health needs of the people.

6. Studies show that only a small percentage of city and county health departments have sanitary engineers. In addition, 73, or 40 percent, of the 185 standard metropolitan statistical areas have incomplete local health department coverage, principally in the fringes. Also, 40 percent of the 207 counties containing cities of 25,000 to 50,000, which are potential standard metropolitan statistical areas, have no local health departments.

7. A large percentage of new homeowners were first-time homeowners who were not aware of problems encountered in fringe areas.

8. The public demand for individual homes is so compelling that it may temporarily continue to overshadow the potential sanitation problems.

Recommendation

There is a serious and pressing need for a general guide for the prevention and solution of fringe area sanitation problems. Such a guide, to be of value, must have the endorsement of the American Public Health Association and the active support of the Public Health Service, Housing and Home Finance Agency, Association of State and Territorial Health Officers, Conference of State Sanitary Engineers, and the Conference of Municipal Public Health Engineers. It is believed that this report incorporates the framework for "a guide for the prevention and solution of fringe area sanitation problems."

Metropolitan Development Conference

Demands created by urban expansion are commanding increasing attention in the Public Health Service.

Because of the rapid growth of metropolitan complexes, health agencies are often pressed to keep pace with community needs. Coordination of environmental health activities with other governmental agency plans for public works, financing, administration, and regional development has become a necessity.

Since 1945, many health departments have found themselves working full time to correct past deficiencies and consequently have few resources left to devote to anticipatory activities.

During the Public Health Service's early efforts in this field, it was recognized that demands for new techniques were less urgent than the need to apply knowledge and methods already at hand. Political, legal, economic, and similar complications too often frustrated and delayed sponsors of technically sound but "unglamorous" physical facilities.

In an effort to identify the means of dealing with urban growth, a conference was called by the General Engineering Branch, Division of Engineering Services, Public Health Service, in December 1959. Thirty-five State and local health and public works officials were asked to meet with housing officials, local and regional planners, political scientists, and other administrators. This group was charged with pointing out the needs and interrelationships of agencies affected by metropolitan development, with particular reference to the role of the public health agency. A number of recommendations resulted from this 2-day conference, and considerable progress has been made toward reaching the set goals.

The concept of a comprehensive approach to guide community development for a healthful environment is still in a formative stage, but it offers the promise of long-term success which segmented attacks have not consistently provided.

With such an approach, individual problems are investigated as they relate to broad community needs and capabilities. Solutions are considered in the light of economic justification, legal limitations, political and administrative arrangements, and public support, as well as from the approach of how adequately the facility is designed to do the job.

An "Environmental Health Planning Guide," soon to be published by the Public Health Service suggests means of approaching this task by explaining facts and procedures necessary to expedite such an approach. The guide will help delineate broad area needs which can then be further investigated and action initiated through local planning or demonstration programs.

This concept of a comprehensive approach does not allow the luxury of a specialized look down a narrow avenue of concern. Instead, it considers environmental health factors in a new light as a vital part of comprehensive community planning. With this concept, instead of posting "no dumping" signs, a plan would seek workable methods for authorizing and financing modern disposal facilities.

It would locate these facilities for most efficient operation for 10 to 20 years ahead. Finally, it would generate the necessary public understanding and participation. No single agency can do all this, but experience has demonstrated that a coalition of civic forces can.

The metropolitan development conference succeeded in framing several basic objectives for guiding further action.

A positive approach was advocated for health agencies at all levels of government, and it was pointed out that the already considerable prestige of local health departments could be enhanced by taking a still more active role in community planning.

In line with the comprehensive approach advocated, use of advisory committees was suggested to bring together various programs now involved in some phase of metropolitan development. Boiled down, this calls for greater interdepartmental and intradepartmental coordination as a necessity for effective action in the web of government.

Adequate training was stressed as a vital need in order that the specialists in particular disciplines learn more of other related community interests. Governmental structures, community economics, planning techniques, and human motivation were mentioned as common training needs for urban area officials.

Implementation of survey findings was brought out as a phase needing attention and more experience.

Demonstration projects conducted by local health agencies under the auspices of State health departments and with the assistance of Public Health Service personnel offer one method of stimulating action and developing greater competency in this area.

Several research needs were suggested to fill existing technical gaps. The subjects mentioned were: (*a*) interim methods for treatment of sewage, (*b*) development of improved methods for removing pollutants in other than central sewage disposal facilities, (*c*) improved methods for collection and disposal of solid wastes, (*d*) development of criteria for the discharge of treated sewage to surface drainage, (*e*) economic feasibility studies for the extension of water and sewerage facilities, together with methods of financing, (*f*) continued development of new and modified on-lot treatment methods together with the development of practical individual household sewage disinfection, and (*g*) quantitative assessment of factors governing the self-purification of polluted ground water and the persistence of ground water contamination.

Admittedly, this research is a big order. Accomplishing it will require time, effort, and a willingness to visualize environmental health as one consideration among many community interests. To the health official it offers a partnership in the team approach needed if the environmental health services for our metropolitan areas are to keep step with today's needs and tomorrow's expectations.—*Metropolitan Planning and Development Activity, General Engineering Branch, Division of Engineering Services, Public Health Service.*

Effects of Compulsory Family Support

Thirty-five States require adult children to contribute money to needy parents, although this is not customary American family practice and raises administrative difficulties as well as questions of equity, according to the author of "Filial Responsibility in the Modern American Family," a new publication of the Social Security Administration.

In the pamphlet, Alvin L. Schorr, family life specialist for the agency, brings together findings of studies in sociology, geriatrics, and social work that summarize relations of adult children and their parents in the United States. From this material, he concludes that old-age assistance and old-age, survivors, and disability insurance programs promote independent living and warm relationships between parents and their grown children.

Policies requiring children to support needy parents are established by the States. Though some saving of old-age assistance funds may be effected, such savings are primarily accomplished by deterring needy old people from applying for assistance. Opinion is divided as to whether such saving is worthwhile, the author contends.

The children of needy old people generally are in modest circumstances and support for parents is likely to interfere with advancement of adults and the nurture and education of their young children. Compulsory support is felt by children in public assistance homes particularly when they are expected, at about age 18, to partially support a parent and siblings. If these children are college material, such financial responsibility would tend to preclude this education, Schorr concludes.

Sanitary Facilities Construction Program for Indians and Alaska Natives

ALBERT H. STEVENSON

THE health status of American Indians and Alaska natives today approaches that of rural dwellers in the United States 50 years ago. In 1958 the average age at death of an Indian was 40 years and of the Alaska native, 30 years, as compared with 62 years for the general population. Diseases of the alimentary canal (gastritis, duodenitis, enteritis, and colitis) rank seventh, higher than tuberculosis, as a cause of death among Indians, excluding those in Alaska. The death rate from these diseases among Indians is seven times higher than for the general U.S. population.

Nearly one-fourth of all Indian deaths and more than one-third of all Alaska native deaths are of infants less than 1 year of age. Infant death rates are more than double those of non-Indian citizens, but this gap widens significantly in the 1- to 11-month age group, after the infant leaves the hospital and lives at home. For this group, the Indian death rate is five times and the Alaska native rate nearly six times that of the non-Indian population. (Subsequently, in this paper the term "Indians" means all Indians, Eskimos, and Aleuts who are beneficiaries of the Public Health Service; "Alaska native" is limited to beneficiaries residing in Alaska.)

The major causes of these infant deaths are respiratory, digestive, infective, and parasitic diseases, all related to the home environment. In general, the sanitation conditions responsible are lack of adequate water of safe quality, accessible and protected, for household use; disposal of wastes in an unsanitary manner, often promiscuously; improper preparation and storage of foods; small, poorly constructed, and overcrowded housing; and lack of basic sanitary practices and personal hygiene in the home.

Open ditches, creeks, ponds, and unprotected shallow wells are common sources of water on Indian reservations. Tens of thousands of Indians haul all water for domestic purposes for a mile or more, using as little as 1 to 3 gallons per capita per day. By contrast, the water consumption of the average urban resident is 50 to 60 gpcd, and rural dwellers living in homes with no inside plumbing use 15 gpcd.

Comprehensive environmental sanitation surveys of Indian reservations have shown that relatively few Indians have satisfactory facilities for the disposal of human wastes or refuse, and complete lack of facilities is not uncommon in a number of communities. Flies and other household insects are frequently a major problem in and about the home. Rodents are of less concern, but in some Indian communities they are a potential menace to health.

The deficiencies in environmental sanitation in village X (a composite example) are typical of conditions in Alaska native villages. The population of 200 lives in frame houses, usually banked with sod and frequently constructed in semisubterranean fashion. Some people have erected houses from square-hewn logs and banked them with moss. All houses are small, generally one room, and grossly overcrowded by any housing standards. They are damp

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from condensation because they lack vapor seals. There are no dishwashing or handwashing facilities.

Water is collected from primitive rain-gutter systems on individual dwellings during the rainy month, but most water for household use is dipped directly from the slough nearby. In the winter, snow and ice are melted in the home.

Slop pails, emptied too close to the water source, and a few crude privies, located too close to the dwellings, are the means of disposing of human wastes. Dogs roaming the village or tethered nearby leave their wastes on the paths, at entrances to homes, and on the stored ice which is the winter water supply. Refuse is dumped in a nearby lagoon.

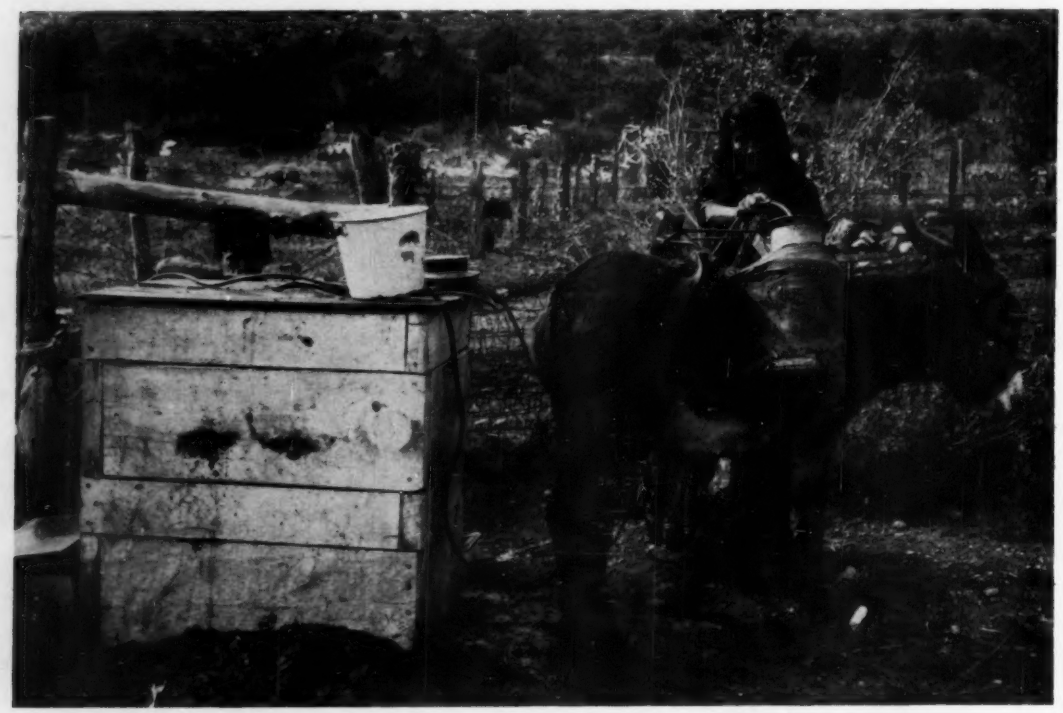
Food is stored in caches raised above ground level as a protection from animals, but freshly killed seals kept inside some homes serve as a source of fuel and food. Fish are cured on racks near the home, but the process often fails to destroy the fish tapeworm.

This is not an indictment of these stalwart people, who are eking out a living under rugged conditions. Through their own ingenuity and effort the people of many villages have improved sanitation; but the correction of such gross deficiencies is not solely a matter of will, or of money, materials, and application of engineering technology.

Other factors—past treatment of various Indian groups by governmental agencies and by people of the other races, cultural patterns, language barriers, limited education, and ability of the local economy to maintain and utilize improvements—must also be considered.

Past Efforts

Initial efforts to improve sanitation on Indian reservations and in Alaska native villages were limited to sporadic surveys, inspections of conditions, and occasional assistance in the correction of glaring deficiencies through a temporary governmental program or a specific congressional appropriation. The first sustained Federal environmental sanitation



Apache Indians get water from a protected source, haul it home by burro

Indians assist in well drilling for a new water supply for Hickiwan on the Papago Reservation in Arizona

program for Indians in States other than Alaska began in 1952 when the Federal Government employed 12 Indian health workers. This limited beginning was given substantial impetus after responsibility for Indian health was transferred from the Bureau of Indian Affairs, Department of the Interior, to the Public Health Service in 1955. The Environmental Sanitation Branch, Division of Indian Health, now includes a staff of 143, exclusive of contract personnel.

Health education was emphasized. Indians were employed as sanitarian aides and trained in the basic elements of sanitation and health education techniques. They were assigned to reservations to work with their own people in improving sanitary practices in the home and in the community. Later, field engineers and professional sanitarians provided support and guidance.

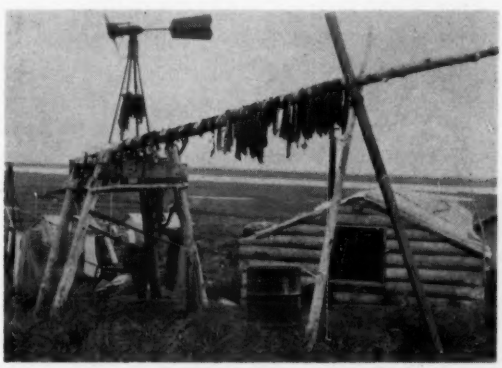
The aides have conducted house-to-house sanitary surveys and stressed "do it yourself" home sanitation projects. Indians have actively participated in community sanitation demonstration projects. Within the resources available to the Indians, sanitary facilities have been improved with technical help from the Public Health Service.

In Alaska, a similar program was initiated in 1955 under a contractual arrangement with the Territorial department of health (now Alaska Department of Health and Welfare). The sanitarian aides, Indians and Eskimos, are only part-time employees who, like their fellow villagers, must supplement their income by seasonal hunting and fishing to survive in this rigorous climate. Sanitarians located at Bethel, Nome, Kotzebue, and Fairbanks visit the villages periodically and supervise the work of the aides. Training courses for the aides have been given the greatest emphasis under this program. When they return to their villages they stress individual home sanitation, disinfection of raw water, conversion of oil drums to sanitary household water storage units, improvement of dog tethering, and the sanitary disposal of wastes.

It has been apparent, however, that an educational and motivational approach is not enough to solve many basic sanitary facility needs which are beyond the available resources of the Indian community. This led to the enactment, July 31, 1959, of Public Law 86–121, popularly known as the Indian Sanitation Facilities Act.

Public Law 86–121

Public Law 86–121 authorizes the Surgeon General of the Public Health Service to (*a*) make agreements with Indians and others relative to contributions toward facilities projects



Drying racks, like these at Scammon Bay, Alaska, are used to cure fish, but the process often fails to destroy the fish tapeworm

and responsibilities for their maintenance and operation, (*b*) acquire land and water rights, (*c*) "construct, improve, extend, or otherwise provide and maintain essential sanitation facilities, including domestic and community water supplies and facilities, drainage facilities, sewage- and waste-disposal facilities, together with necessary appurtenances and fixtures for Indian homes, communities, and lands," and (*d*) "transfer any facilities provided . . . to any State or subdivision or public authority thereof, or to any Indian tribe, group, band, or community, or in the case of domestic appurtenances and fixtures, to any one or more of the occupants of the Indian home served thereby."

The act directs the Surgeon General to consult with and encourage the participation of the Indians concerned and States and political subdivisions thereof in carrying out its provisions. It also authorizes the Secretary of the Interior to transfer to the Surgeon General certain interests and rights in federally owned or Indian-owned lands, with appropriate safeguards for the Indians.

Initiation of Typical Project

Following are the steps in initiating a typical project.

1. The Indian beneficiary group sends a written project proposal to the Indian health area office through the nearest Public Health Service Division of Indian Health facility. (The Service works through official Indian groups and does not accept project proposals from individual beneficiaries.)

2. The area sanitary engineer consults with the Indians, Bureau of Indian Affairs, and State and local health officials and assists the Indian group in developing a long-range plan to meet the sanitation needs of the reservation or community.

3. A Public Health Service engineer discusses the project with the beneficiaries and develops a project summary including a brief statement of existing conditions, justification for the project, a brief outline of the project with engineering data and cost estimates, and comment on how the facilities can be maintained and operated. He will also obtain information necessary for establishing a priority for construction.

4. At the area office the following criteria determine the project priority for construction:

(*a*) Urgency of health need of Indian population in locations to be served.

(*b*) Engineering and economic feasibility.

(*c*) Ability and willingness of Indian tribes, communities, or groups to assume or share with other public bodies the responsibility for maintenance and operation of sanitary facilities to be provided.

(*d*) Ability and willingness of Indian tribes, communities, or groups to participate by contributing labor, materials, equipment, service, or funds.

(*e*) Relationship of project to broader plans for sanitation improvement developed or approved by Indian tribes, communities, or groups.

(*f*) Enactment or applicability of enforceable sanitary laws, ordinances, or regulations calculated to aid in accomplishing the purposes of the construction in the area to be served by the facility.

5. The project proposal, project summary, and project priority are then forwarded to headquarters in Washington, D.C., for review, consolidation with projects from other areas, budgeting, and approval.

6. After approval by headquarters, the area office staff appoints a project engineer, negotiates final agreements with Indians and others, acquires land and water rights, and prepares final plans and specifications.

7. Plans are forwarded to the State health agency for review and comment.

8. Construction is undertaken either by contract or directly by the Public Health Service using contributed labor.

9. Concurrently with project construction, instruction is undertaken in the beneficiary community on utilization, maintenance, repair, and protection of the new sanitary facilities.

10. When construction is finished, operators of the facilities are trained, and after an initial period of operation, the completed facilities are transferred to the eligible group or public body in accordance with initial agreement.

As a general policy the Public Health Service has limited the authority under the act to maintain sanitary facilities under special conditions such as an emergency breakdown which is beyond the resources of the Indians to repair, or temporary operation of a newly completed community facility while Indian operators are being trained under a planned and phased arrangement. The Public Health Service role is one of technical assistance in setting up mechanisms under which the Indians, adjacent political subdivisions, or public authorities assume responsibility for operation and maintenance of completed facilities.

Studies (*1*) have demonstrated that marked reduction in the enteric diseases can be expected when safe water becomes readily accessible in the home and when human waste is disposed of in a sanitary manner. Control of insects and rodents and protection of stored water and foodstuffs can further improve the health level. Rough preliminary estimates of needed sanitary facility projects indicate that some $35 to $50 million will be required to meet the essential needs of our Indian communities. It is recognized further that these projects should be undertaken only after the beneficiary groups are willing to participate actively in the construction of facilities and to assume responsibility for operation and maintenance of the completed works.

Indian families and groups who are considered to be beneficiaries of the Public Health Service can participate in these projects. However, additional considerations will tend to limit the numbers who may benefit under a facilities construction program in contrast to one of services.

Implementation of the Act

Policies and procedures have been developed for implementing the construction program. They include responsibilities, functions, and relationships of various organizations and groups concerned; scope of projects which may be included; criteria for determining project priorities; guidelines for operation and maintenance of Indian sanitary facilities and for handling emergency situations; and step-by-step procedures for development and conduct of a project.

The program is conducted on a decentralized basis through seven Indian health area offices located at Anchorage, Alaska; Aberdeen, S. Dak.; Billings, Mont.; Portland, Oreg.; Phoenix, Ariz.; Albuquerque, N. Mex.; and Oklahoma City, Okla. Joint planning with the Indian groups and with appropriate Federal, State, and local agencies is stressed. Indian participation through contributions of labor, funds, materials, and services is a basic part of the activity. Practicable maintenance and operation mechanisms are worked out in advance of project execution through agreements with the beneficiary group (see box).

In Alaska, it has been recognized for some time that practicable facilities for water supply and waste disposal in native villages must be adapted to the permafrost, climatologic factors, and the life and economy of the native population. The Division of Indian Health has financed studies of these conditions at the Arctic Health Research Center for the past 5 years. Some practicable methods are now available for jetting wells, for protecting water intake lines from freezing, and for storage of water. Additional information on the chemical and physical quality of Alaska waters is being obtained, and simple treatment methods for removal of iron from water are under further study. During the summer of 1960 a study of "readily available" ground water was conducted by a field crew in six native villages. Projects underway in 1961 include water supply and waste disposal facilities for Akiachak, Napaiskiak, Napakiak, Tuntatuliag, and Tyonek.

In the Indian community of Hoonah, Alaska, special features of the act are being used to collect and dispose of refuse. Under an agreement with this community, the Public Health Service supplies a special collection vehicle and a bulldozer for operation of a sanitary landfill. Both vehicles were obtained from excess Department of Defense property at no cost to the Public Health Service. Hoonah transports the equipment and operates the collection service and disposal facility in accordance with recommended sanitary practices. Revenue from a

service charge to residents supports the operation. Incidentally, the bulldozer will also keep the streets cleared in winter so that refuse collection service may be maintained.

Conclusion

In conclusion, the sanitary facilities construction program for Indians is not an entitlement. It is an opportunity to meet a challenging health problem at home with dignity for the beneficiary groups. It stresses a self-help approach and acceptance of responsibility by the beneficiaries for the continued operation and maintence of completed facilities.

REFERENCE

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Rheumatic Disease Studies

Leading specialists from the United States and abroad presented the latest findings on arthritis and rheumatic diseases at a meeting of the American Rheumatism Association in Dallas, Tex., December 9 and 10, 1960.

A study at the Cornell Medical Center, New York City, strengthens the suspicion that predisposition for the severe skin disease, scleroderma, frequently confused with rheumatoid arthritis and characterized by atrophy and hardening of the skin and other soft tissues, may run in families.

In clinical and serologic tests of 91 blood relatives of 24 patients with scleroderma, Dr. Josue M. Corcos, Dr. William C. Robbins, Dr. Bernard Rogoff, and Dr. Ralph Heimer of the rheumatic disease department, Hospital for Special Surgery, found that while only one relative had some of the skin abnormalities encountered in the disease, 7 percent had rheumatoid arthritis. A significant number of the apparently healthy relatives exhibited a positive test for the so-called rheumatoid factor, a mysterious substance found in the blood of arthritics.

Eight of 24 (33 percent) scleroderma patients showed elevated gammaglobulin levels and antinuclear antibodies known to be specific for lupus erythematosus. Corcos and his co-workers concluded that these results supplied additional evidence for the close relationship between scleroderma and other diseases of connective tissue and suggested the occurrence of scleroderma in families where a genetic predisposition for abnormalities of immune systems exists.

The influence of cortisone and other steroid medications on the course of peripheral neuropathy, a nerve disease which frequently accompanies rheumatoid arthritis, was reported by Dr. Richard H. Ferguson and Dr. Charles H. Slocumb of the Mayo Clinic, Rochester, Minn., after a long-range study at the clinic.

Ferguson and Slocumb reported no examples of polyneuropathy were found in 5,188 rheumatoid arthritis patients in the presteroid period, 1945–49, but 61 cases were discovered between 1959–60 when steroids were widely used to suppress temporarily joint inflammation characteristic of rheumatoid arthritis. The Mayo Clinic team found that in a patient habituated to large doses of corticosteroids relative adrenal insufficiency as a result of stress or dosage reduction may set the stage for the appearance of polyneuropathy.

A report by Dr. John Abruzzo and Dr. Charles L. Christian of the Presbyterian Hospital in New York City sheds new light on mysterious substances found in the blood of patients suffering from rheumatoid arthritis and related rheumatic diseases.

These scientists have produced in laboratory animals a blood substance resembling the human rheumatoid factor.

"DIRECTION OF THE WIND"

SEATO CONFERENCE ON CHOLERA

A Conference on Cholera, sponsored by the South-East Asia Treaty Organization and the National Institutes of Health, Public Health Service, as part of the SEATO Cholera Research Program, was held in Dacca, East Pakistan, December 5–8, 1960. The conference was attended by official representatives of all SEATO nations. Reports on all aspects of cholera—clinical, public health, and research—were presented and discussed by scientific delegates from the SEATO nations and Japan. Summaries of each session were prepared by the chairmen and rapporteurs and read at the final session, "Direction of the Wind." Dr. Joseph E. Smadel, chief, Laboratory of Virology and Rickettsiology, Division of Biologics Standards, and Jane Stafford, chief, Scientific Reports Branch, Office of Research Information, National Institutes of Health, have made it possible for *Public Health Reports* to publish an early account of the major developments. The complete proceedings of the conference will be published in the near future. Following are the summaries of each session essentially as given at the conference.

Clinical Manifestation and Management

Chairman: Dr. Luang Binbakya Bidyabhed (Pyn), Under Secretary of State, Ministry of Public Health, Bangkok, Thailand

Rapporteur: Dr. Theodore E. Woodward, University of Maryland, Baltimore

The comments of the essayists and discussers provided the assembly a thorough review of the classic manifestations of this violent diarrheal disorder and an authoritative account of the dramatic effect of properly implemented, enlightened corrective and control measures.

Modern cholera does not vary from the illness which ravaged Bengal and the world in the past century. Asymptomatic patients are undetected unless sought carefully, and a mild illness similar in many aspects to various types of gastroenteritis accounts for many cases. Historically, cholera as described vividly by Dr. A. K. M. Abdul Wahed, Pakistan, is characterized by an unrelenting purge leading to dehydration which knows no peer in clinical medicine. The published proceedings of this conference will provide an authoritative and readable description of cholera in its florid form.

Cholera gravis is a medical emergency of catastrophic proportions. Ironically, the vibrio may cause human illness so subtle as to elude diagnosis and so rapid as to outdistance treatment. The physician who adopts a casual and inadequate attitude toward patients with

acute cholera will assume the role of executioner. Delay can be tragic.

Fatalities, which conventionally run about 50 percent, were reduced during the Bangkok epidemic in 1958–59 to 8 percent. This achievement resulted from teamwork and the application of rational scientific principles. Physicians, nurses, students, public health workers, civil servants, and others joined to make it possible.

Each speaker emphasized the need for prompt detection of cholera with immediate attention directed toward restoring the patient's normal circulation and tissue lubrication. The time-honored methods used in Thailand in 1958–59 to bring the epidemic under control were applied with dispatch. Many played a significant role. It is not remarkable that patients soon appreciated the value of corrective treatment and voluntarily sought help through hospitalization. It was recalled that the first Thai patient with cholera became ill on May 23, 1958, came to the attention of health authorities on May 24, and the disease was confirmed bacteriologically by May 26.

With extreme dehydration, there are systemic manifestations as well as the prominent intestinal involvement. Circulatory collapse is common in all severe cases, and it is likely that all organs show changes which are either primary or secondary to circulatory abnormalities.

The physiologist has given the practitioner a practical, workable treatment guide. Copious quantities of water with added saline, glucose, and alkali are essential to rejuvenate the circulation, bathe the tissues, and correct the electrolyte imbalances. The physician cannot delay or be too cautious.

However, occasionally overzealous intravenous alimentation can lead to adverse circulatory sequelae, such as cardiac failure and pulmonary edema. Careful bedside observations of the skin, pulse, blood pressure, respiration, and general reaction aid in management. Simple laboratory aids, such as the determination of specific gravity of plasma or blood by the copper sulfate method, may be applied in most situations. Each speaker emphasized forcefully the rewards which accrue from prompt fluid replacement soon after onset in the home or while the patient is en route to the hospital.

Cholera patients react poorly to drugs such as opiates, atropine, antibiotics, and cardiac stimulants. These should be used only when unmistakably indicated, and then with care. The rationale for using adrenalin is unclear, and its routine use should be condemned.

Dehydrated patients are thirsty. Cholera patients are no exception, although vomiting interferes with administering fluids via the natural route. No effective means other than intravenous alimentation has allayed this sign. Perhaps an efficient antiemetic drug would serve a useful role and aid in treatment of those patients for whom intravenous fluids are unavailable.

Our nursing associates have made many valuable contributions including instituting progressive care by having patients contribute to their own care.

There is much to be done in the future in spite of the recent revelations which have more clearly defined the physiological abnormalities of the gastrointestinal tract and elucidated the key fluid and electrolyte changes. The whole patient must be studied as a dynamic unit by a clinically oriented team including physiologists, endocrinologists, and biochemists. The greater and lesser circulation from the heart to the capillaries must be appraised by direct and indirect methods. The blood, including leukocyte function, should receive concentrated attention. The liver, pancreas, kidney, and adrenal must be brought into sharp focus. The central nervous system and particularly the mysteries of its circulation in cholera are untouched. Isotope techniques can contribute to developing a clear view of blood supply and function of the intestine and other organs. It would be redundant to outline the various indicated studies required to provide the necessary information. Determination of the venous pressure as suggested by Dr. Graham Bull, United Kingdom, should be included.

Limited groups of well-chosen cases of cholera gravis should be studied on the ward of the Pakistan-SEATO Cholera Research Laboratory when personnel and facilities can be

assembled. The groundwork established by the U.S. Naval Medical Research Unit No. 2 and Thai groups is of inestimable value and represents a firm reference point. Obviously, bacteriological and immunological determinations should be a facet of the total case analysis. Examination of all tissues obtained at postmortem is essential and should include differential staining procedures. Likewise, it may be possible to perform biochemical analysis of intestinal and hepatic tissue. Dr. Eugene J. Gangarosa's group at Walter Reed Army Institute of Research has provided much needed impetus.

Antibacterial drugs should be given a critical trial before they are scrapped from the cholera regimen. The study should be designed carefully, utilizing sufficient numbers of patients who receive antibacterial drugs and appropriate fluid and electrolyte replacement and a control group who receive only the replacement therapy. Whether the sulfonamides, antibiotics, or steroids are useful or necessary is unknown since there are no reliable controlled data.

All of this should make interesting hunting since mechanisms of the disease are unclear, and the fatality rate in patients with cholera gravis is too high.

Physiological Changes in Cholera

Chairman: Dr. Graham Bull, Queen's University, Belfast, Northern Ireland

Rapporteur: Dr. Robert S. Gordon, Jr., National Institutes of Health, Bethesda, Md.

This session was important for two reasons: first, two papers explained the genesis of the cholera stool, a most important advance; and second, a further series of papers provided information on which an improved therapeutic regimen can be based. In summarizing the session, we propose to consider the papers in three groups.

Pathogenesis

The papers of Dr. Robert S. Gordon, Jr., National Institutes of Health, and Dr. G. S. Huber, U.S. Navy, in conjunction with Gangarosa's paper at the session on pathology and pathogenesis, give for the first time a real understanding of the genesis of the cholera stool. The picture that emerges is as follows.

The intestinal mucosa, contrary to past belief, is histologically intact, and in confirmation of this, Gordon has shown that large molecular weight substances do not traverse it. This explains why the stool protein content is low. The fluid making up the stool is not an exudate. Why then does an apparently intact mucosa allow such a large loss of water and electrolytes?

Huber's convincing explanation is that there is a specific poisoning of the so-called sodium pump byproducts of the cholera vibrio. This requires an explanation.

Normally, the cells of the body are in a state of equilibrium with the extracellular fluid. This is not a static condition but one in which large volumes of water and quantities of electrolyte move rapidly across the cell membranes in both inward and outward directions. Despite the large flux of water and electrolytes, the ionic compositions of the cell fluid and the extracellular fluid are quite different. Sodium is present in much higher concentration in the extracellular fluid than in the cell, and potassium is in higher concentration in the cell than in the extracellular fluid. This is due to the fact that enzyme systems in the cell, which derive their energy from oxidative processes, selectively extrude sodium from the cell and retain potassium. This system is known as the sodium pump. In fact, it is a coupled double pump simultaneously moving sodium out of the cell and potassium into it. When there is a failure of the pump, sodium enters the cell and potassium leaves it. In the gut, this means that sodium enters the gut lumen by diffusing along a concentration gradient from the extracellular fluid and potassium also leaks along a gradient from the cell to the lumen.

We find this hypothesis of a poisoning of the sodium pump entirely convincing to explain the electrolyte losses in the stool, but there is one aspect of the genesis of the stools which we think requires further elucidation. Why is there such a large volume of water in the stools? We hear that the stool osmolarity, as measured by the Fisk osmometer, is some 40 or more milliosmols lower than the plasma, and furthermore, the oncotic pressure of the plasma is presumably some 30 mm. Hg higher than the stool because of the plasma proteins. These

two pressures combined appear to be far greater than the available filtration pressure. Why then does water move from plasma to lumen? This is a matter which we think could be approached in a number of ways.

We think more detailed studies on the osmotic properties of cholera stools are required. In particular, we would think it worthwhile to search for oncotically active medium-to-large molecules in the stools. These could not be proteins, proteoses, or polypeptides because the stools contain little biuret-positive material, but we do know that there are considerable quantities of mucopolysaccharides present. It may be that a sufficient amount of these are in the form of small enough molecules to exert a considerable oncotic pressure. Incidentally, if this proved to be the case, one could envisage an effective therapy by feeding substances which would cause aggregation of these molecules.

Apart from defining the osmotic gradients more accurately we think one might attack the matter of the filtration pressure. On the gut nephron hypothesis of Dr. Lee E. Farr, Brookhaven National Laboratory, one might envisage the occurrence of an increased filtration pressure resulting from a decrease in afferent arteriolar tone. His techniques would help here.

A simpler approach is also possible. A semidirect measurement of the capillary pressure might be obtained in the following way. If a glass fiber flexible enteroscope were passed into the intestine inside a transparent balloon, one could raise the pressure in the balloon until the gut blanched. The balloon pressure would then reflect the capillary pressure. Various other approaches are possible, but we think it would be inappropriate to devote more time here to this matter.

Therapeutic Considerations

Three communications from Dr. R. Q. Blackwell, U.S. Navy, Dr. Robert A. Phillips, U.S. Navy, and Dr. Mongkol Kruatrachue, Thailand, provide for the first time detailed information on the state of water and electrolyte balance in cholera patients and information on the quantities of water and electrolytes lost in the stools. Knowledge of these matters is essential if we are to plan therapy intelligently.

There are two problems in the management of any patient with a disturbance of water and electrolyte balance. The first is to decide how much water, what electrolytes, and what quantities of electrolytes should be given to restore a normal milieu intérieur. The second is to maintain a normal milieu intérieur by balancing the losses of water and electrolytes by an equal intake. We are concerned first with restoration and then with maintenance of balance.

We find from these papers that cholera behaves very predictably. From a knowledge of some simple indicators it is possible to assess the extent and type of water and electrolyte imbalance and also to predict from measurement of the stool volume alone what electrolyte losses are occurring.

Such information enables us to make up a repair solution which provides the necessary concentrations of the different ions to correct the imbalance. The actual quantities of such repair solutions have been shown to be predictable from a simple measurement of the plasma specific gravity or, at certain stages, of whole blood specific gravity. This use of the plasma or whole blood specific gravity is so important that we hope you will excuse a repetition of the principle behind it.

When water is lost from the extracellular fluid and plasma, the concentration of plasma proteins rises. The extent of this rise can be used as a measure of the volume of fluid lost. Now, one of the most accurate and simplest methods of measuring the plasma protein concentration is to determine the plasma specific gravity. Phillips and his team have shown that the volume of fluid required to restore balance can be estimated from the following formula: $(x-1.025)200=$milliliter of repair solution required (where x is the plasma specific gravity of the patient).

As an indicator of underhydration, the plasma specific gravity has been shown to be both efficient and sufficiently simple for use in field conditions.

However, we believe that further work should be done to find even simpler indicators of the extent of underhydration for use in more remote areas. Two of these were suggested in the discussion. One was an evaluation of the skin turgor, and the other the use of venous pressure measurement. Despite certain con-

trary opinions offered in the discussion, we believe that the latter could be used, not perhaps as an indicator of the volume of fluid required for rehydration but certainly as an indicator of adequate hydration. We would suggest that fluid might be given until the venous pressure is 1 or 2 cm. below the sternal angle. At this point, the patient could not be dangerously overhydrated and would certainly be adequately hydrated. It has been used successfully as an indicator of hydration in conditions other than cholera, and we believe that it should be studied in cholera.

Maintenance Therapy

The data we have been given provide a means of regulating maintenance therapy. On the one hand we have information on the insensible loss of fluid in tropical conditions, and on the other we have data on the composition of the stools. These two pieces of information make it possible to prescribe a routine maintenance regimen without the necessity for laboratory investigations. This is possible because of the small variation in the sodium and potassium content of the stools reported by Blackwell.

The studies of the Navy team are most valuable. The simple routine of management of cholera which they prescribe will become standard practice.

Before leaving this consideration of management there are, however, two points which require comment. First, we are told that there is little or no cellular underhydration and also that there is often as much as 30 percent reduction in potassium balance. We are a little doubtful that these two statements can be reconciled.

The second problem concerns the tonicity of the repair solutions. From Phillips' data one would expect to find that a regimen based on isotonic fluids would lead to cellular underhydration. This does not appear to occur unless one interprets some of the pyrexia as being due to this phenomenon. Why is it that regimens of treatment based on isotonic or slightly hypertonic fluid have been reported previously as being superior to those based on a slightly hypotonic fluid? We doubt whether they are superior, and we think control studies are indicated. This, incidentally, is a problem which is admirably suited for study at the Dacca laboratory.

Farr outlined certain procedures which in the future may be used to elucidate some of the problems of water and electrolyte movement in cholera. Clearly, radioactive isotope techniques are admirably suited to such studies. Of particular interest is Farr's novel concept of a "gut nephron."

Pathology and Pathogenesis

Chairman: Capt. Robert A. Phillips, MC, USN, Naval Medical Research Unit No. 2, Taipei, Formosa

Rapporteur: Dr. Eugene J. Gangarosa, Walter Reed Army Institute of Research, Washington, D.C.

Dr. Chanyo Benyajati, Dr. Natth Bharamapravatpi, Thailand, and Col. S. M. H. Bokhari, Pakistan, have given us a lucid account of the pathology of cholera. We are sure Chanyo is correct in assuming that the majority of the damage is due to ischemia. However, if one assumes that inhibition of active transport plays a role in the intestinal lesion, then one should examine the acute and convalescent patient to ascertain whether the active transport mechanism in the nephron is also inhibited. If such were found in the kidney, it would imply that the transport mechanism in the entire body is deranged and not just in the intestine.

Bull has called attention to the need for considering lymph flow in estimating renal function and to the idea that lymph flow assumes increasing importance as renal function decreases. His studies again emphasize the need for a suitable experimental animal in which this disease can be reproduced. If such a model were available, one could determine the rate of flow and the electrolyte composition of lymph from the gastrointestinal tract. Studies of this type are required if one is to postulate precise mechanisms for movement of water and electrolytes across the mucosal cell. This has been fully discussed by Dr. Maurice B. Visscher and his group at the University of Minnesota.

Natth emphasized the alterations of adrenal histology in fatal cases of cholera. Obviously, future clinical studies should attempt to assess the role of corticosteroids in the initiation or the maintenance of the diarrhea of cholera.

The papers of Gangarosa and Gordon, at the session on physiological changes in cholera, provided the coup de grâce for the theory that cholera is a disease characterized by demonstrable destruction of the mucosal cells of the intestine with "weeping" of protein containing extracellular water into the gut lumen.

The failure to find viral agents as frequent inhabiters of the gastrointestinal tract in patients with cholera has been reported in papers by Dr. F. S. Cheever, University of Pittsburgh, and Dr. P. B. Johnston, U.S. Navy, and their associates. Until new virological techniques are developed, comparable in their importance to tissue culture methods, the idea that cholera gravis may represent a dual infection, that is, virus plus vibrio, can be shelved.

Dr. Abbaya Chamuni, Thailand, reported reasonably consistent success in reproducing a choleralike disease in rabbits and poor success in monkeys. Perhaps these data provide a tool for ascertaining why some human beings become cholera victims while others are spared. Abbaya employed adult rabbits while Dr. Nirmal Dutta of the Haffkine Institute in Bombay, India, used baby rabbits as his experimental host. Such studies should be repeated and extended in other laboratories. Inability to reproduce the disease in experimental animals with assured regularity has greatly hampered studies of the basic physiological lesion in cholera which accounts for the severe diarrhea. This fact has led the Navy investigators to turn from a bacteriological to a physiological approach in an attempt to replicate the disease in animals.

Vaccines and Immunity

Chairman: Dr. Kenneth Goodner, Jefferson Medical College, Philadelphia, Pa.

Rapporteur: Dr. Joseph E. Smadel, National Institutes of Health, Bethesda, Md.

Remarks from representatives of each delegation opened the session on vaccines and immunity. These comments were concerned mainly with the current status of cholera in each country, the kinds of vaccine employed and the methods of use, and the opinions of the speakers regarding the efficacy of the vaccination program in controlling the disease.

Dr. Daizo Ushiba, Japan, pointed out that there has been no cholera in Japan since 1947, the disease having been reintroduced the preceding year by repatriates. He mentioned that, prior to 1926, cholera was introduced each summer but never overwintered in Japan whether vaccine was or was not used. In several instances prior to 1926, data collected retrospectively suggested that the disease was appreciably less frequent among the vaccinees than among nonvaccinated persons in the same area. However, he did not consider the observations as providing definitive data on the efficacy of the vaccine. He concluded by referring to the earlier experience of Japanese health and preventive medical officers in Manchuria. They were of the opinion that cholera vaccine was probably as good as typhoid vaccine.

Dr. Jesus Azurin, Philippines, indicated that at no time had more than 41 percent of the population of the Philippines been vaccinated against cholera and that many of these had not had a second injection. He stated that no field studies on the efficacy of the vaccine had been conducted in the Philippines. His country relies more heavily on quarantine procedures than on an immunization program to prevent cholera.

Dr. Luang Binbakya Bidyabhed (Pyn), Thailand, said that the Thai experience with cholera in 1958–59 did not permit him to say much regarding the efficacy of vaccine even though about 20 million inoculations had been given during the period, and many persons in the epidemic area had been vaccinated on more than one occasion. He noted that an inverse correlation occurred each year between the number of inoculations and the number of cases; as the former rose higher and higher the latter dropped lower and lower.

Dr. J. Gallut, France, reviewed the experience of French investigators and health officers in Indochina. He noted that it was difficult to form an opinion about the efficacy of a vaccine when it is used only during an epidemic. However, the experience over the years suggested that when about 70 percent of the population in an area was vaccinated the epidemic died out.

Dr. M. M. Siddiq Husain, Pakistan, stated that a modified Haffkine vaccine was employed in Pakistan. He noted that epidemics came

and went before vaccines were developed, and this increased the difficulty of evaluating the efficacy of such immunogens.

Dr. Ataur Rahman, Pakistan, summarized data on field experience with vaccine in East Pakistan. The results suggested some immunity among the vaccines.

Dr. Joseph E. Smadel, National Institutes of Health, summarizing the remarks of the preceeding speakers, said he was impressed with the unanimity of opinion that cholera vaccine was of some value even though everyone stated that conclusive scientific data on its efficacy were lacking. It was apparent that an adequate field evaluation of cholera vaccine was necessary.

The latter half of the session consisted of more formal presentations on several different subjects.

Dr. John C. Feeley, National Institutes of Health, summarized experimental observations on a potency test for cholera vaccine using mice. This procedure, which compares the vaccine under test with a reference vaccine, gives consistent results. Moreover, representative vaccines from different sources have markedly different potencies. Feeley emphasized that before any potency test could be accepted with confidence as a biologics control procedure, its results must be shown to correlate with demonstrated capacity of vaccines to protect persons in the field against the disease.

Ushiba reported data on serologic and cellular immune responses in mice inoculated with several types of vaccine prepared for *Salmonella typhimurium*. He indicated the need for similar studies with *Vibrio comma*.

Dr. Kenneth Goodner, Jefferson Medical College, summarized his studies on the antibody response in patients with cholera. This development provided a much needed test for epidemiological and immunological investigations. Both group and type-specific antibodies were found in convalescent patients. The latter were of particular interest since they correlate by type with the organism isolated from the patient. These type-specific antibodies may be associated with immunity and certainly will be valuable in diagnostic work. Presently available cholera vaccines varied greatly in their capacity to induce type-specific antibodies in animals.

Dr. Colin MacLeod, New York University, listed a number of essentials for a field trial of cholera vaccine:

1. Conduct the trial in a readily accessible area where cholera occurs in epidemic form at reasonably frequent intervals.

2. The supporting laboratory should have sound and adequate facilities for isolation and identification of *V. comma* and for serologic diagnostic work with the vibrio. In addition, diagnostic facilities for *Salmonella* and *Shigella* should be available. In brief, the associated laboratory should be capable of establishing etiological diagnoses on the acute diarrheal diseases which occur in the study area.

3. Give the vaccine under investigation in a properly randomized manner with a control vaccine, presumably typhoid vaccine, given to those who do not receive cholera vaccine.

4. Immunize the population under investigation before the anticipated epidemic, with two or three doses so spaced as to take full advantage of the booster phenomenon.

5. Staff the trial with an adequate number of trained personnel to gather information and maintain proper records on patients with classic clinical disease and, equally important, on those with milder involvement and with asymptomatic infections.

6. The study group cannot be very large if the individuals are to be maintained under the intense observations proposed. The exact size of the population will depend on the likelihood of predictable epidemic conditions.

7. Vaccine used in the field trial should be studied by standard and special laboratory assay procedures. Moreover, adequate samples of the field trial vaccine should be retained for possible future use as a potency standard.

In discussing MacLeod's criteria, Dr. H. E. Shortt, United Kingdom, emphasized the need for a controlled experiment of the type outlined. He indicated the essentiality of a marriage of field and laboratory procedures if an answer were to be obtained on the efficacy of cholera vaccine. He favored careful selection of a relatively static population for the trial and suggested that the vaccine should contain fresh local as well as classic strains. He noted

a proper trial may be some years away since much needs to be done in the laboratory and in the study area before the definitive test could be undertaken.

We would like to turn for a moment from the pleasant task of reporting, in an objective fashion, on the scientific presentation of the session on vaccines and immunity to a few personal observations. We wish we were able to express in words the enthusiasm and faith of the participants in the idea that recent developments have provided us, health officers and scientists from various nations, with the tools to build a worthy edifice on the foundations laid by our predecessors. We believe that the crusading spirit of this group is such that the individual members will use the new tools in the vigorous pursuit of their own studies on cholera, both here and at home. Perhaps the emotional drive generated at this meeting will be even more important than the current array of factual data in the early attainment of the control of cholera and in its eventual eradication. In closing we express our esteem and thanks to the participants. Their efforts have made the session on vaccines and immunity a memorable meeting.

Epidemiology

Chairman: Dr. Fred L. Soper, director, Pakistan-SEATO Cholera Research Laboratory, Dacca, East Pakistan

Rapporteur: Dr. J. L. Stockard, deputy director, Pakistan–SEATO Cholera Research Laboratory, Dacca, East Pakistan

This century has seen a great reduction in the geographic distribution of cholera in the world in comparison with that of the preceding one. No invasion of the Americas has occurred since 1900, and during the past 30 years, and even since World War II, cholera has receded from the Pacific. The only notable spread of cholera in recent years to a noncontiguous area was a short-lived invasion of Egypt in 1947.

The first decade of the second half-century began with a minimal recognized distribution of cholera; both West Pakistan and Thailand which had outbreaks in late 1940's were free from 1950 to 1958. However, in the past 3 years, 1958 to 1960, cholera has shown a capacity for expansion. In 1960 outbreaks were recorded in many parts of India, East Pakistan, Burma, Nepal, West Pakistan, and Afghanistan. Classic clinical cholera apparently disappeared from Thailand in 1959 during the second year of an epidemic first noted in May 1958.

The generally accepted concept of the epidemiology of cholera is that East Pakistan and a contiguous area of India constitute the permanent endemic focus where the infection is always found and from which it tends to spread more or less widely each year as circumstance permits. Health authorities of Thailand were alerted to the increased threat of invasion by cholera early in 1958 by reports of increased activity of the disease in Calcutta.

The story of the recent epidemic in Thailand is a fascinating one when superimposed on a history of practically constant endemicity from 1916 to 1949 (with marked epidemic waves 1919 to 1920, 1925 to 1929, 1935 to 1937, and 1943 to 1947) followed by a total absence of observed cases from 1950 to May 1958. This outbreak was characterized by great rapidity of spread to some 38 Provinces of the country in a few weeks and a rapid decline following the onset of the heavy monsoons, but with a considerable recrudescence in 1959. On the basis of clinical observation, it has been assumed that the cholera outbreak in Bangkok terminated in October 1959. Continuing bacteriological studies have resulted in reports of continued isolation of *Vibrio cholerae* from certain diarrheal cases and from the environment until the summer of 1960. The epidemiological significance of this report is not clear.

West Pakistan is not part of the endemic cholera focus. It suffered a serious outbreak during the troubled period from 1947 to 1949, but was then free until November 1958 when the disease was observed in a few towns not far from the Indian frontier. After a quiet period in 1959 the disease reestablished itself in West Pakistan in May 1960, apparently imported from the port of Bombay. The spread of the infection has been attributed to both water and food, and the epidemic was still continuing in certain areas in November 1960.

Unfortunately, details of the outbreaks of cholera reported in 1960 are not available from Afghanistan, Nepal, and Burma.

The many gaps in our knowledge of the epidemiology of cholera in its permanent endemic seedbed and in the widely varying epidemic conditions such as those in Thailand and West Pakistan emphasize the need for a careful restudy and evaluation of existing knowledge. The organism itself, its biology, in vivo, in vitro, and its ability to persist under natural conditions must all be reexamined. How does the cholera vibrio vary in nature, and what are the factors which cause it to become avirulent? To recover its virulence (if it does)? Other points needing careful study are immunity, vaccination, susceptibility, interepidemic foci, the effect of the habits of the people, the climate, the environment, and the salinity of contaminated waters. What are the factors which permit the natural resolution or the involution and disappearance of the infection responsible for epidemics?

Do East Pakistan and parts of India constitute a permanent endemic focus of cholera because the natural conditions there permit the persistence of the cholera vibrio in contaminated waters throughout the year? Will improved water supplies and sanitation alone be sufficient to end cholera in these endemic areas?

The data on reported cases of cholera in East Pakistan for the past decade, averaging almost 18,000 annually, establish beyond doubt the wisdom of locating the SEATO Cholera Research Laboratory in this area. It must be remembered, however, that it is not sufficient to study a communicable disease only in the endemic area.

The experience with yellow fever in the Americas is most significant. A survey of the geographic distribution of immunity to yellow fever and the systematic collection and routine examination of postmortem material from individuals dying after any rapidly fatal febrile illness revealed two unrecognized mechanisms for the maintenance of the yellow fever virus: (*a*) silent yellow fever endemicity in northeast Brazil based on an uncommonly close association of man and the domestic mosquito vector, *Aedes aegypti*, in rural areas and (*b*) yellow fever of forest primates transmitted by mosquito vectors other than *A. aegypti*.

It is important that studies continue in Thailand, now that cholera is apparently absent, and that West Pakistan be studied as another area where conditions are quite different from those in East Pakistan. Although the cholera research laboratory is located in Dacca, it is not intended that studies should be localized here, but rather that Dacca may serve as the center for studies of the disease in this region.

In considering the adequacy of quarantine regulations for the prevention of the international dissemination of cholera, it should be remembered that any regulation capable of preventing absolutely the movement of cholera from one area to another, particularly across extensive land frontiers, would, for all practical purposes, interrupt the movement of normal traffic and commerce. Countries as intimately related as are East and West Pakistan and India, Burma, and Thailand will always find it difficult to apply quarantine measures. Cholera represents, par excellence, the type of communicable disease which must be prevented and eradicated in its permanent foci of infection, rather than contained by building airtight quarantine walls about these foci for the protection of the rest of the world.

A renewed faith in the reliability of the agglutination test performed with freshly cultured vibrios opens the way to geographic studies of the previous distribution of cholera by laboratory methods without depending on the notification of clinical cases. A better understanding of the true epidemiology of cholera can be expected to arise from the routine study of this disease in different areas over a considerable period of time.

It is only as more knowledge based on observation in the laboratory and in the field becomes available that a reasonable program for cholera control and eventual eradication in its endemic foci can be prepared.

Laboratory Identification of Cholera Vibrios

Chairman: Dr. M. M. Siddiq Husain, Bureau of Laboratories, Karachi, Pakistan

Rapporteur: Dr. Colin M. MacLeod, New York University, New York, N.Y.

Although extensive study has been devoted to it for considerably more than a century, the subject of cholera is confused. In the area where one might wish for and perhaps expect more certitude, that is, the nature and proper-

ties of the etiological agent, *Vibrio cholerae*, there exists the greatest degree of uncertainty. An understanding of the epidemiology of the disease and interpretation of the effects of infection in the individual patient demand a much more precise knowledge of the biology of this microbial species and its protean manifestations. It is by no means agreed that we are dealing with disease caused by a single bacterial species or that under the term "cholera" there is jumbled together a group of diseases that might better be referred to as "vibrioses," as Goodner suggested.

The problem can be stated in two questions. What are the criteria for inclusion of bacteria in the species *V. cholerae?* What are the significance and relationship of the many variants of *V. cholerae* that have been described, of the nonagglutinable vibrios, and of the multitudinous water vibrios?

Dr. Abdul Saeed Khan, Pakistan, reviewed the current cultural, morphological, and serologic criteria for identifying *V. cholerae*. Saeed emphasized the necessity of multiple criteria with final decision resting heavily upon the use of antiserums to subgroup 01 and specific Inaba and Ogawa antiserums.

Dr. Ampan Tasniyavej, Thailand, reviewed and discussed critically the laboratory methods employed in the Bangkok epidemics of 1958–59. Specimens were collected by means of rectal tubes and implanted on three solid media and in alkaline peptone water. Cultures negative for *V. cholerae* were obtained from clinically positive cases in the following incidence on the various solid media.

Solid medium	*Percent of cultures negative for V. cholerae*
Lactose bromthymol blue agar	22.0
Alkaline human blood beef extract agar	8.8
Taurocholate beef extract agar	17.0

Further identification was made by direct slide agglutination with specific Inaba and Ogawa antiserums of micro-organisms from emulsified colonies on these three media. In addition, suspected colonies of *V. cholerae* were picked and planted on triple sugar iron agar.

Ampan concluded that at least two solid media, such as alkaline human blood beef extract agar and taurocholate beef extract agar, should be used for direct inoculation of stools during epidemics, and that slide agglutination with specific Inaba and Ogawa antiserums is a most valuable procedure for rapid and accurate identification.

Dr. Kazi Abdul Monsur, Pakistan, reviewed his experience with the modified gelatin taurocholate tellurite agar medium, pH 8.5, developed by Goodner. This medium, as tested in Philadelphia with artificial stool mixtures containing some 38 different strains of vibrios, has the advantage of being highly selective for *V. cholerae* without being seriously inhibitory. The distinct halo about colonies of *V. cholerae*, due to the action of its gelatinase, is of great assistance in making a presumptive identification. Monsur concluded that this medium is promising and should be tested in the field. Field trials have begun at the SEATO Cholera Research Laboratory in Dacca.

Maj. Samnieng Buspavanich, Thailand, reported on his group's experience in the 1958–59 epidemics with the use of alkaline tellurite lauryl sulfate agar and the Wilson-Reilly-Pandit agar medium, which contains bismuth sulfite, mannitol, and phenol red. Both media were found to be useful for primary isolations, although not entirely selective. Samnieng noted that under the climatic conditions of Bangkok during the hot season plain alkaline agar, blood media, and alkaline agar containing bile salts were unsatisfactory for primary culture because they permitted overgrowth of *Pseudomonas* and *Proteus*.

Gallut reported on variations in titer of *V. cholerae* 0 agglutinability in subgroup 01 antiserum as related to differences in polysaccharide content of the 0 antigen in various strains. Employing phenol extraction, Gallut found that the polysaccharide content may vary between 1.0 and 6.5 percent of the weight of the bacteria. However, the content of polysaccharide of a given strain on a given medium remains relatively constant under uniform conditions of growth and extraction. If autolysis is permitted to occur, polysaccharide is liberated into the medium and the bacteria become relatively inagglutinable. Under these circumstances a strain of *V. cholerae* might be diagnosed as a nonagglutinable vibrio.

Similar differences in agglutinability may be observed with certain strains and monospecific Inaba and Ogawa antiserums.

Gallut reported a correlation between agglutinability of *V. cholerae* and the color of colonies under oblique illumination. The agglutinating titer of vibrios from blue colonies was about half that of vibrios from green or orange yellow colonies. Variation in color of colonies of *V. cholerae* under oblique lighting is believed to be due to differences in content of polysaccharide in the 0 antigen complex.

Finally, Gallut, on the basis of agglutination studies with four recently isolated strains using specific Ogawa and Inaba antiserums, was able to confirm the report of Burrows and co-workers (*Journal of Infectious Diseases* 79: 168, 1946) that a fourth type of *V. cholerae* exists.

Goodner emphasized the great variation in characteristics of "authentic" *V. cholerae* isolated in different places, in different epidemics, and even at different times during the same epidemic. He discussed the strong possibility that there is a group of diseases and not a single disease. He suggested that it might be more appropriate, therefore, to speak of "vibrioses" to indicate this group or series of diseases which are now included under the term "Asiatic cholera."

Goodner stated there are at least 50 different variants among the 500 strains of cholera vibrios in his collection. This finding emphasizes the inadequacy of picking only a single colony for identification from a plate. Such demonstrated variability also raises the possibility that the vibrios growing on the wall of the bowel during the disease may differ in an important way from those found in the rice water stool or following primary isolation on one or other of the selective media in current use.

Goodner was of the opinion that it is premature to standardize the preparation of serologic reagents used in diagnosis because the present state of knowledge is not adequate to do this intelligently.

In the general discussion there was sentiment expressed for and against the term "vibrioses." It was stated that the word has already been employed to describe infection by *Vibrio fetus*. This was not held to preclude the use of the term in the present context.

Many discussants commented on the difficulties in bacteriological diagnosis because of the variability of the vibrio under various conditions of culture and maintenance. In order to resolve some of the pressing problems Samnieng suggested that a small working committee of the present conference be set up. This committee would be concerned with the cultural and serologic characters of the micro-organisms and their relation to disease production. The suggestion was seconded by Goodner, who noted that a good beginning could be made through correspondence.

The co-existence of enteric infections caused by various species of *Salmonella* and *Shigella* during cholera outbreaks was commented on by various participants. They emphasized the need to use culture media in addition to those which are highly selective for *V. cholerae* to obtain a complete picture of enteric infections. In this regard, Husain reported the occurrence of an enteropathic strain of *Escherichia coli* during the latter part of the cholera epidemic in Karachi in 1958. This agent, represented by 38 strains, was associated with bloody diarrhea. Husain also referred to the possibility of interaction between various different species or genera of enteric bacteria to produce strains of high pathogenicity.

The session on laboratory identification highlighted the need for a detailed study of the nature and extent of variation in the cholera vibrio employing modern techniques. The study should include selection of spontaneous mutants in the presence of specific antibody and other selective agents and especially the role of genetic transduction of various characters by bacteriophages and correlation of these changes with morphological, chemical, and metabolic analysis. Unless extensive studies of this type are made, it is likely that we will remain in the present unsure but opinionated state.

It should also be possible to learn more about the behavior of the cholera vibrios as they grow in the gut, since this might give a lead to possible toxic products not yet identified. Specifically, are the vibrios growing under partially

anaerobic conditions during the acute stage of the disease when they are found in overwhelming numbers in the fluid stools? Their relatively poor growth in the laboratory under conditions of complete anaerobiosis suggests that in the bowel growth is more likely to be aerobic, especially when this finding is taken in conjunction with the alkaline reaction of the rice water stool. However, the conditions in vitro are so dissimilar to those in the intestinal tract that active multiplication under conditions of anaerobiosis might take place in the gut, although this is not found in laboratory media.

Copper Poisoning on Shipboard

On January 28, 1960, a radio message advised U.S. Coast Guard Headquarters that several men on board a cutter operating an ocean weather station patrol had become ill with mild nausea after drinking water contaminated with an unknown substance. The water had an alum taste and turned blue on contact with soap.

By reference to an item published in the *U.S. Navy Medical News Letter* of January 1, 1960, it was quickly established that the illness was due to copper poisoning resulting from faulty operation of a post-mix soft-drink vending machine. The *News Letter* item was an abstract of a paper entitled "Copper Poisoning From Vending Machines" by S. H. Hopper and H. S. Adams, published in *Public Health Reports,* October 1958.

Investigation revealed that during repairs to a vending machine aboard the cutter, copper tubing had been substituted for the original plastic and stainless steel tubing of the water supply line and had been used also to connect the liquefied carbon dioxide gas to the machine. The check valve on the water supply line was faulty, permitting carbon dioxide to flow back into the potable water supply.

Some 2 years earlier, men on the same cutter had experienced similar illnesses after drinking beverages from the vending machine, but only during warm weather.

Coast Guard Headquarters immediately notified all units to investigate at once all soft-drink vending machines for improperly used copper tubing and fittings and ineffective high-pressure check valves and to make necessary corrections or disconnect the equipment. Instructions were issued in March giving detailed specifications for the proper installation of carbonated beverage machines to prevent the entrance of carbon dioxide or carbonated water into the potable water supply of a vessel. A kit can be purchased with materials for making the mechanical correction.

Soon after the initial order, a letter from a Coast Guard district office described incidents of copper contamination of drinking water from a different source. In these incidents, which had occurred several years earlier on 255-foot WPG's, contamination was the result of chemical cleaning of evaporators without adequate flushing of distiller-condensers, the letter stated. The evaporators, of the atmospheric pressure type, had been cleaned with an acid cleaner shortly after arrival in port. Acid fumes, or vapor with acid, had collected on the distiller-condenser tubes and apparently had remained there, reacting with the copper in the admiralty metal tubes until the vessel went to sea, at which time a large amount of copper was noticeable in the water.

Such contamination can be prevented, the letter continued, by backflushing the distiller-condenser sections of an evaporator with a neutralizer, a solution of water and boiler compound, or plain water, immediately after chemical cleaning of the equipment. Whether the same type of reaction will occur with cupro-nickel distiller-condenser tubes is not known, but it is probable that contamination would be less.—CAPT. JAMES H. LE VAN, *commissioned officer of the Public Health Service on assignment as chief sanitary engineer officer, Medical Division, and* COMDR. ELLIS L. PERRY, *assistant chief, Naval Engineering Division, U.S. Coast Guard.*

Isolation of Leptospira canicola From Skunks in Louisiana

EARL E. ROTH, D.V.M., W. V. ADAMS, B.S., and DONNA LINDER, B.A.

LEPTOSPIROSIS caused by *Leptospira canicola* was first recognized in dogs in the Netherlands by Klarenbeek and Schuffner in 1933 (*1*) and has since been found to be widespread among dogs throughout the world. Human infections with *L. canicola* have been reported from various parts of the globe (*2*). Van der Hoeden isolated the organism from cattle and swine during outbreaks of leptospirosis in these species in Israel (*3–5*). Since dogs and jackals in that area were found to be carriers of *L. canicola*, they were considered as possible sources of infection. Jackals were considered to be more important than dogs. In Israel, serologic evidence of infection was found also in horses, mules, and donkeys. Van der Hoeden (*6*) also recovered *L. canicola* from two species of hedgehog, *Hemiechinus auritus* and *Erinaceus europaeus transcaucosicus*, which are related members of the family Erinaceidae. Kmety (*7*) recovered *L. canicola* from swine at an abattoir in Czechoslovakia. In Russia, *L. canicola* was recovered from the brown rat, *Rattus norvegicus* (*8*). In a personal communication from London in 1960, C. E. Smith and co-workers reported isolation of *L. canicola* from the small rat, *Rattus exulans*, in Malaya.

The authors are with the department of veterinary science, Agricultural Experiment Station, Louisiana State University, Baton Rouge. *The work described in this paper was part of Southern Regional Research Project S–30. The latter part of the investigation was supported in part by research grant E–2348 (R–1) from the National Institute of Allergy and Infectious Diseases, National Institutes of Health, Public Health Service.*

In this country, *L. canicola* was first isolated from dogs by Meyer and co-workers (*9,10*); however, *L. canicola* infection has since been found to be widespread among dogs (*11,12*). Human infections have been reported by a number of workers. More recently, during epidemiological studies of an outbreak of canicola fever in man by Ward and associates (*13*) and Williams and associates (*14*), *L. canicola* was isolated from human beings, dogs, and a sow. This was the first time *L. canicola* had been recovered from swine. The human epidemic was associated with bathing in a creek accessible to dogs, swine, cattle, and wild animals. The cattle in that area showed serologic evidence of past infection with *L. canicola*, but the organism was not isolated from them. Turner and co-workers (*15*) recently reported the isolation of *L. canicola* from a 2-day-old sick calf. Serologic evidence of leptospirosis in raccoons caused by *L. canicola* was reported by Reilly (*16*).

This report describes the isolation and identification of five strains of leptospires recovered from striped skunks, *Mephitis mephitis*, collected in Louisiana. These strains were homologous with *L. canicola*, strain Hond Utrecht, and represent a new host-serotype relationship. This is the first bacteriologically verified report of *L. canicola* infection in a wild animal host in the United States.

Materials and Methods

Collection and processing of animals. Most of the skunks in the study were collected in south central Louisiana between the Mississippi and Atchafalaya Rivers. A few were collected

west of the Atchafalaya River. This area is primarily agricultural and is moderately populated with cattle and dogs. It is heavily populated with striped skunks. The methods employed in processing the animals are described in detail elsewhere (*17*), except for dark-ground examination of the 10 percent kidney suspensions. These were made by using the same dark-field system for examining semisolid cultures as has been described previously (*17*). If the first preparation proved negative, a second preparation was examined.

Cultural procedures. Five types of semisolid mediums were employed: Fletcher's (*18*) basal medium containing rabbit serum, Fletcher's basal medium containing horse serum, modified Stuart's (*19*) medium containing rabbit serum, modified Stuart's medium containing horse serum, and Chang's (*18*) basal medium containing rabbit serum. Not all five mediums were employed for each specimen. Semisolid mediums were inoculated with 3 to 5 drops of 10 percent kidney suspension. Three plates of solid medium prepared according to the method of Cox and Larson (*20*) were inoculated with 0.1 ml. of 1:10, 1:100, and 1:1,000 dilutions of 10 percent kidney suspension. Remaining details pertaining to cultural procedures have previously been described (*17*).

Serologic procedures. All antiserums were prepared as described by Alexander and coworkers (*21*), except that 10-day-old cultures were used. Antigens employed in the microscopic agglutination test and in the agglutinin-absorption procedure were prepared and were employed in these procedures as previously described (*17*), except that a dilution scheme providing for final tenfold dilutions ranging from 1:100 to 1:100,000 was used in the initial screening studies of the five canicola isolates. In all other studies, the interlocking tenfold scheme of Wolff (*18*) was used. A 1+ reaction was considered positive. The antigens employed are indicated in tables 1 and 2.

Leptospiral serotypes. Strains of the following serotypes were employed to produce antigens and antiserums:

ballum, MUS 127
canicola, Hond Utrecht
icterohaemorrhagiae, M 20
bataviae, Swart
grippotyphosa, Moskva V
pyrogenes, Salinem

Table 1. Cross agglutination reactions of the isolates and Leptospira canicola, Hond Utrecht, with antileptospire serums

Antileptospire serums	Homologous titers	Reciprocal of titer against antigen	
		L. canicola	Isolates [1]
	Initial screening study [2,3]		
L. canicola	10, 000	10, 000	10, 000
L. pyrogenes	10, 000	([4])	1, 000
L. ballum	100, 000	([4])	100
L. icterohaemorrhagiae	10, 000	([4])	100
	Cross agglutination study [5]		
L. jonsis	100, 000	10, 000	10, 000
L. patane	10, 000	10, 000	10, 000
L. malaya	100, 000	3, 000	3, 000
L. sumneri	100, 000	10, 000	10, 000
L. schueffneri	30, 000	3, 000	3, 000
L. benjamin	100, 000	10, 000	10, 000
L. canicola	10, 000	10, 000	10, 000

[1] Strains: LSU 1113, LSU 1114, LSU 1116, LSU 1346, and LSU 1347.
[2] Tenfold dilution scheme, 1:100 to 1:100,000.
[3] No reactions at 1:100 against *L. bataviae, L. grippotyphosa, L. autumnalis, L. pomona, L. sejroe, L. hyos, L. harjo, L. semaranga, L. djatzi, L. djasiman, L. sentot, L. australis A, L. zanoni, L. alexi, L. medanensis, L. javanica,* and *L. andamana.* Homologous titers were 1:10,000 or 1:100,000.
[4] Not done.
[5] Interlocking tenfold scheme, 1:100, 1:300, 1:1,000, 1:3,000, and so on.

autumnalis, Akiyami A
pomona, Pomona
sejroe, M 84
hyos, Hyos
hardjo, Hardjoprajitno
semaranga, Veldrat S 173
alexi, HS–616
djatzi, HS–26
djasiman, Djasiman
sentot, Sentot
australis, Ballico
zanoni, Zanoni
medanensis, Hond HC
javanica, Veldrat Batavia 46
andamana, CH 11
jonsis, Jones
sumneri, Sumner
schueffneri, Vleermuis 90 C
benjamin, Benjamin
malaya, H–6
patane, Patane

All strains were supplied by the Division of Veterinary Medicine, Walter Reed Army Institute of Research, Washington, D.C.

Results

Since February 1959, 180 isolations of leptospires have been obtained from 310 striped skunks. Identification studies have been completed for 12 strains; 7 were *L. pomona* and 5 were *L. canicola*. This report is concerned with *canicola* strains LSU 1113, LSU 1114, LSU 1116, LSU 1346, and LSU 1347, which were isolated from skunks 17, 18, 19, 41, and 42, respectively.

All five strains were isolated by the agar plate method (*17*) employing the solid medium described by Cox and Larson (*20*). Strain LSU 1113 produced 39 colonies on plate 1, 5 on plate 2, and 1 large spreading colony on plate 3. The growth of strain LSU 1114 was confluent on plate 1, colonies were too numerous to count on plate 2, and a few leptospiral colonies along with some colonies of contaminents were produced on plate 3. Strain LSU 1116 produced colonies too numerous to count on plates 1 and 2 and 39 colonies on plate 3. They eventually covered the entire plate. Plates 1 and 2 were grossly contaminated for LSU 1346; however, areas of leptospiral growth were present between the contaminants on plate 3. Strain LSU 1347 produced several spreading colonies on plate 1, whereas plates 2 and 3 remained negative. Leptospiral growth was noted on the sixth day for strains LSU 1113 and LSU 1114. Strain LSU 1116 was positive on the eighth day, and strains LSU 1346 and LSU 1347 were found positive by the 15th day.

Four of the five *canicola* strains were obtained in pure culture by direct inoculation of

Table 2. Results of cross agglutinin-absorption tests with Leptospira canicola and the canicola isolates

Antiserum against—	Absorbed with—	Reciprocal of titer against antigen [1,2]			
		Homologous strain		Absorbing strain	
		Before	After	Before	After
L. canicola	*L. canicola*	10, 000	Negative	10, 000	Negative.
	LSU 1113	10, 000	do	10, 000	Do.
	LSU 1114	10, 000	do	10, 000	Do.
	LSU 1116	10, 000	do	10, 000	Do.
	LSU 1346	10, 000	do	10, 000	Do.
	LSU 1347	10, 000	do	10, 000	Do.
LSU 1113	LSU 1113	100, 000	do	100, 000	Do.
	L. canicola	100, 000	do	100, 000	Do.
LSU 1114	LSU 1114	30, 000	do	30, 000	Do.
	L. canicola	30, 000	do	30, 000	Do.
LSU 1116	LSU 1116	10, 000	do	10, 000	Do.
	L. canicola	10, 000	do	10, 000	Do.
LSU 1346	LSU 1346	100, 000	do	100, 000	Do.
	L. canicola	100, 000	do	100, 000	Do.
LSU 1347	LSU 1347	100, 000	do	100, 000	Do.
	L. canicola	100, 000	do	100, 000	Do.

[1] Living antigen was used.
[2] Negative indicates no reaction in a 1:100 dilution.

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semisolid mediums with 10 percent kidney suspension. Semisolid cultures of strain LSU 1346 were positive for leptospires; however, contamination was present in all tubes. Strains LSU 1113 and LSU 1114 were isolated in all semisolid mediums except Chang's. Strains LSU 1116 and LSU 1347 were positive in all semisolid mediums, except that modified Stuart's medium containing horse serum was contaminated in the case of LSU 1116 and was not used in the case of LSU 1347.

Initial screening and additional cross-agglutination studies clearly showed the serologic affinity of the isolates for the *canicola* serogroup (table 1). Since the cross-agglutination pattern of the isolates was found to be the same as for *L. canicola*, reciprocal agglutinin-absorption studies were performed with *L. canicola*, Hond Utrecht (table 2).

The serums of the five skunks from which these isolates were obtained were tested against the first 21 antigens listed. The serums had low agglutinin titers for *L. canicola*. The serum from skunk 18 showed a titer of 1:1,000; titers for the other four were 1:300. Heterologous titers of 1:30 to 1:100 were found for *L. ballum* and *L. pyrogenes*. These are commensurate with infections of *L. canicola*. The serum from skunk 41 agglutinated antigens prepared from *L. hardjo*, *L. sejroe*, and *L. medanensis* to a titer of 1:100 and also agglutinated the antigen of *L. canicola* to a titer of 1:300. The serums were negative for the remaining 21 antigens.

Four of the five 10 percent kidney suspensions from which *L. canicola* was isolated were positive by dark-field examination. The suspension from skunk 41 was negative. Large numbers of leptospires were observed in the positive suspensions from skunks 18 and 19.

Since the preparation of this report was begun, eight additional strains of leptospires isolated from skunks were found to have the same agglutination pattern as the five strains being reported. These are probably strains of *L. canicola*.

Discussion

The demonstration of *L. canicola* infection among skunks directs additional attention to their potential role in the transmission of leptospirosis in this country. The skunk has been shown to be a host for *L. ballum* and *L. pomona* (*22*). The occurrence of a member of the *hyos* serogroup in skunks has been reported (*23*). Galton and associates (*24*) reported the isolation of a new member of the *hebdomadis* serogroup, for which the name *L. mini georgia* was proposed. Serotypes represented among the 180 leptospiral isolates obtained from skunks in Louisiana are *L. pomona*, *L. ballum*, *L. canicola*, and serotypes of the *hyos* and *hebdomadis* serogroups (*17*). From these studies it appears that the skunk is readily infected with a number of diverse serotypes of *Leptospira*. These infections apparently are not fatal. In the majority of instances, even though the skunk proves to be bacteriologically positive, gross lesions of the kidneys are minimal or undetectable.

The discovery of an additional natural host for *L. canicola* further complicates the epizootiological picture, particularly since *L. canicola* has recently been found to cause bovine and porcine leptospirosis. The public health significance of leptospirosis caused by *L. canicola* has already been established. Skunks are sometimes found at night feeding among resting cattle, thereby affording the necessary association for interspecies transmission of leptospires. The question that remains open is whether the skunk becomes infected from cattle, dogs, or other animals, or whether it serves as a reservoir of *L. canicola*. Nevertheless, it could certainly provide an intermediate link in a chain of interspecies transmissions and thereby play an important epizootiological role. Its mode of living is conducive to intraspecies transmission and this may help to explain the high rate of *L. canicola* infection among skunks in Louisiana.

Since skunks are sometimes trapped, descented, and sold as pets, their possible public health significance cannot be overlooked. As pets they are in contact with human beings and other pets and domestic animals.

The low agglutinin titers for *L. canicola* observed in the serums of the five skunks from which *L. canicola* was isolated emphasized the limitations of epizootiological studies based on serology alone. They did, however, elicit a

predominant titer for *L. canicola*. Even though Wolff and Broom (*25*) reported slight cross reactions between *L. canicola* and *L. schueffneri* antiserums with members of the *hebdomadis* serogroup, it appears that the reactions observed suggest that skunk 41 had previously been infected with a serotype of the *hebdomadis* group. Furthermore, *L. hardjo*, a member of the *hebdomadis* group, has been isolated from cattle in Louisiana (*19*).

Summary

Isolation of *Leptospira canicola* from five striped skunks, *Mephitis mephitis*, collected in Louisiana establishes a wildlife source of *L. canicola* in the United States that may infect man and animals. All five strains were isolated by direct inoculation of solid medium with diluted kidney suspension. Four of the five strains were obtained in pure culture by direct inoculation of five types of semisolid mediums with 10 percent kidney suspension. Employing the microscopic agglutination test and the agglutinin-absorption test, all five strains were shown to be homologous with *L. canicola*, Hond Utrecht.

Agglutination tests with serums of the five skunks revealed low but predominant serotiters for *L. canicola*. The serum from one skunk also agglutinated antigens of the *hebdomadis* serogroup.

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The Public Health Service's Program In Cancer Control

LEWIS C. ROBBINS, M.D.

WHAT is cancer control? The Public Health Service's concern with this question led, in 1957, to the integration of the research resources of the National Cancer Institute with the resources for developing State and local programs of the Bureau of State Services. The result of this integration is the Cancer Control Branch, which is located in the Bureau and carries out the Public Health Service's cancer control responsibilities. The director of the National Cancer Institute is technical adviser to the Cancer Control Branch and focal point for all cancer activities in the Public Health Service.

The director of the institute and I, as chief of the Cancer Control Branch, in seeking an answer to the question, what is cancer control? thought that a more realistic understanding of cancer control would emerge if we turned to the medical practitioner for his definition. What did the private practitioner think was cancer control?

Therefore, soon after being assigned to the new Cancer Control Branch, I visited 32 practicing physicians who had served as advisers in community public health programs. Their frank and informal comments led to extensive discussions with groups of physicians throughout the United States during the next year and a half. Regional conferences were held with physicians representing 10 national medical organizations, including the American Cancer Society, having major concerns in cancer control, and also with State medical societies and State health departments. In all, more than 250 physicians participated in the conferences. Cancer control was carefully scrutinized in small discussion groups which permitted a thorough explanation of the common viewpoint, and a better understanding of the term began to emerge for all the participants.

Because we wished to have continuing access to the practitioners' viewpoint and to insure a flow of advice and information on cancer control, a 14-member advisory committee was chosen to advise the Cancer Control Branch on a formal basis. Nine clinicians are on the advisory committee, and all its members are physicians with experience in cancer diagnosis, treatment, research, teaching, and administration of cancer programs.

Cancer Control

Cancer control, we were told, is, simply stated, the sum total of efforts to prevent cancer, to diagnose cancer early, and to treat cancer adequately. We learned that three factors limit cancer control.

- Cancer control is partial in that the knowledge of how to control cancer is incomplete. Present knowledge and methods do not permit 100 percent survival from cancer.
- Cancer control is local control, for if it is to reach people with cancer the potential must exist in the local community. There is no cancer control for those who are too far removed from services and facilities. Therefore, the local community has the responsibility for pro-

Dr. Robbins is chief of the Cancer Control Branch, Division of Chronic Diseases, Public Health Service. *This paper was presented before the 4th National Cancer Conference in Minneapolis, Minn., September 13–15, 1960, and will be published in the proceedings of the conference.*

viding services and resources for its cancer patient.

• Cancer control must reach the person with cancer. Optimum cancer control can be anticipated only by careful arrangement by all parties concerned: the patient, the private physician, and general community resources. Before the physician can reach maximum effectiveness, the cancer patient must be sufficiently well informed to play his part. For each patient, a minimum quality of good medical practice must exist: casefinding must be prompt and accurate, treatment must be appropriate and adequate, and followup must be diligent.

Can Cancer Be Prevented?

If primary prevention of cancer were possible, there would be no risk of late diagnosis, no necessity to use extremes of treatment to serve a greater good. There is a feeling today, however, as we learned in the discussions, that there are important possibilities in primary prevention even though final proof of their efficacy is lacking.

From the comments of our advisory committee and the regional conferences, we learned that there are many services which may supplement and assist the physician in the early diagnosis and treatment of cancer. However, since these supportive activities should help and not hinder the practitioner in his cancer control efforts, he has a major concern in their development.

The Cancer Control Program

Our first step in the development of a cancer control program has been to learn, with other voluntary and official agencies and through appropriate liaison with the medical profession, what supplementary aids to cancer control are desired by the medical practitioners. As a second step, we plan where possible to aid those cancer projects of official and voluntary agencies which can, with a little added support, make even greater contributions than heretofore.

The Cancer Control Branch has three major resources to help the clinician in his control efforts. These resources comprise a grant program for State health departments, community cancer demonstration project grants (first appropriated in fiscal year 1959 to develop projects at the community level), and, finally, a staff of consultants who provide assistance in nursing, health education, and epidemiology.

The major activities of the Cancer Control Branch follow.

Grants to States for cancer control. Grants to State health agencies have been spent for various cancer control activities in the light of the States' special needs and interests. These include such activities as aid to tumor registers, public and professional education, and followup services. In 1960, the amount appropriated by Congress for these grants increased from $2.25 million to $3.5 million. The States' use of these funds is summarized in a booklet the Cancer Control Branch has published entitled "Cancer Services, Facilities, and Programs in the United States, 1960." We note from their programs that the State health agencies increasingly are making use of advisory committees similar to the Cancer Control Branch's to assist them in planning cancer control and in determining the allocation of grants.

Cancer registers. Various organizations have urged assistance for local tumor registers in order that those that seek approval of the American College of Surgeons may know their own cancer survival rates. The Cancer Control Branch is assisting a project of the American College of Surgeons which is designed to compile information on tumor patients. And the branch has helped State health agencies through State grants to assist tumor registers.

Education of physicians. The education of physicians is a responsibility of the entire medical profession, with voluntary and official agencies providing such technical assistance, when requested, as they may be able to offer. The Cancer Control Branch has been able to offer technical assistance in audiovisual aids to several medical groups, including the American Academy of General Practice.

Screening for cancer of the cervix. In cooperation with several Public Health Service hospitals, the Cancer Control Branch is helping to screen people eligible for public medical care for cancer of the cervix. At a minimum, the hospitals hope that every woman, before being discharged as an inpatient or outpatient, will be given the opportunity to have an examination to learn whether she is shedding malig-

nant cells from the cervix. For other Federal hospitals without pathologists, the Cancer Control Branch is promoting cytodiagnosis by having its laboratory, the Washington Cytology Unit, examine smears of exfoliated vaginal cells. The branch is also encouraging other Federal and State medical care programs to screen their beneficiaries for cancer of the cervix.

Community demonstration project grants. In 1959 Congress appropriated $1.5 million to further the widespread application of existing knowledge of preventing and controlling cancer. The Cancer Control Branch's advisory committee makes recommendations on all applications for these grants. During the first year, 100 applications were received. Of the 82 requests on which action was completed, 49 grants totaling almost $1.4 million were approved. Twenty-five projects were approved for community services and 24 for cytodiagnostic training. Grants are made to official health agencies and nonprofit organizations and institutions conducting or assisting community programs for the prevention and control of cancer. Guidelines for the use of these funds are available from the Public Health Service. The hope of the advisory committee is to encourage the development of projects that will help every community reach its theoretical potential in controlling cancer.

Primary prevention. The Public Health Service joins every physician in his earnest endeavor to prevent cancer. Today, there are two important possibilities in primary prevention.

Cancer of the cervix, many believe, may be prevented in large part through treatment of chronic cervicitis. Better care for 6 weeks postpartum may reduce cervical cancer incidence.

The second possibility lies in the primary prevention of lung cancer. Few will disagree that the smoker has a higher risk of getting lung cancer than has the nonsmoker. Lung cancer is rare in the nonsmoker, but in the general population in the United States lung cancer is the leading cause of cancer death.

In line with the position of the Public Health Service on this matter, which is detailed in Surgeon General Leroy E. Burney's article, "Smoking and Lung Cancer" (*Journal of the American Medical Association*, November 28, 1959), the Cancer Control Branch is making efforts to keep physicians informed about developments in this field. The branch hopes to see physicians in every community determine, on the basis of all the evidence, what constitutes good practice when a patient asks, "Doctor, what about smoking?"

In these six major activities, in many minor ones, and in others to come, the Cancer Control Branch is and will be guided by the expressed needs of those controlling cancer, the medical practitioners.

The Accident Toll

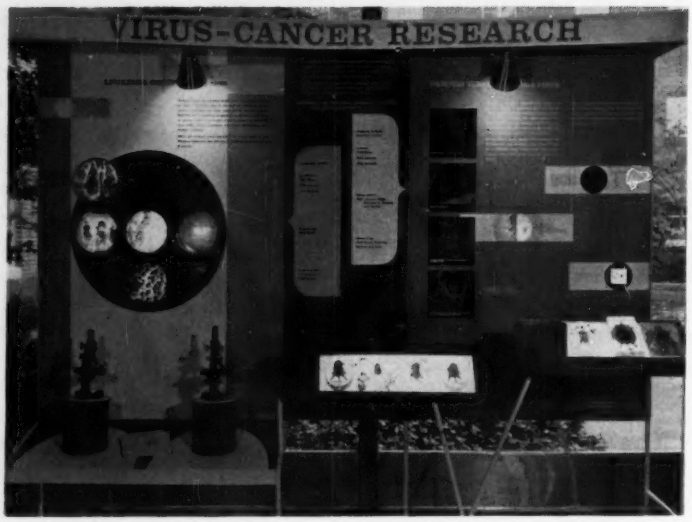
According to the National Safety Council, accidents cost the American people $100 billion from 1950 to 1960.

Fifty percent of all teenage deaths are now caused by accidents. . . . Every 2 years in the United States, almost as many Americans die from traffic accidents as the number of Japanese killed in Hiroshima. . . . There is growing evidence that as many as 50 percent of the drivers and pedestrians killed in traffic accidents had been drinking prior to the fatal accidents.—A. L. CHAPMAN, M.D., *chief, Division of Accident Prevention, Public Health Service, in a talk at the National Conference on Driving Simulation, Santa Monica, Calif., February 27–March 1, 1961.*

National Cancer Institute Exhibits

The National Cancer Institute has four new exhibits available for loan to professional groups. They were prepared especially for the Fourth National Cancer Conference held in Minneapolis, Minn., in September 1960.

In most instances, shipping costs for the exhibits will be borne by the National Cancer Institute. Prospective borrowers should write to the Information Officer, National Cancer Institute, Bethesda 14, Md., at least 2 months in advance, giving details of the meeting, such as expected attendance, type of audience, dates of meeting, location, and provision for labor to set up and dismantle.



CHANGING CONCEPTS CONCERNING CANCER (*lower left*). Prepared jointly by the National Cancer Institute and the American Cancer Society, this exhibit presents changing concepts in cancer research and control from three approaches—prevention, diagnosis, and treatment.

Specifications: 3 sections, requiring a 15-ft. backwall, 8-ft. height, and 1 outlet for 500 watts. Weight, crated, approximately 1,500 lbs.

VIRUS-CANCER RESEARCH (*upper right*). New developments in research on mammalian cancer caused by viruses are summarized. Research at the National Cancer Institute on the Moloney leukemia virus and the polyoma virus is presented in detail.

Specifications: 3 panels, requiring a 10-ft. backwall, 8-ft. height, and 1 outlet for 1,000 watts. Weight, crated, approximately 700 lbs. If possible, borrower should provide two monocular microscopes for viewing slides supplied by the institute.

INTERNATIONAL ASPECTS OF CANCER (*not illustrated*). The national and international effort against cancer, a worldwide menace, is presented. Variations in occurrence of the disease by race, socioeconomic status, and geographic location are shown. A "push-button" device shows above or below average occurrence of cancer of the lung, stomach, esophagus, breast, cervix, and liver in various areas in the world.

Specifications: 3 panels, requiring a 10-ft. backwall, 8-ft. height, and 1 outlet for 500 watts. Weight, crated, approximately 600 lbs.

CANCER PUBLICATIONS AND JOURNALS (*not illustrated*). This display includes representative publications prepared by the National Cancer Institute and the American Cancer Society for lay and professional audiences, sample copies of cancer journals published in the United States, and selected foreign cancer journals.

Specifications: 4 sections, requiring a 12-ft. backwall, 8-ft. height, and 1 outlet for 300 watts. Weight, crated approximately 450 lbs.

GEOGRAPHIC VARIATION IN INCIDENCE OF SKIN CANCER IN THE UNITED STATES

Harry Auerbach, M.P.H., J.S.D.

THE LITERATURE supporting a relationship between exposure to ultraviolet rays and skin cancer is reviewed by Blum (*1,2*). Variations in human skin cancer incidence rates with differences in latitude in the United States were shown by Dorn (*3*), who used data collected from 10 large metropolitan areas in 1937–38. For white males and females in three separate latitude areas, the study showed an inverse relationship between incidence of skin cancer and distance from the equator, that is, the closer the area is to the equator, the higher the incidence.

The National Cancer Institute of the National Institutes of Health, Public Health Service, repeated the survey of the 10 cities during the years 1947 and 1948. This survey provided data on the incidence of skin cancer by age, sex, and color in each of the cities (*4–13*). The present study used these data to determine a more precise relationship between latitude and skin cancer incidence by age and sex.

The incidence rates for the total white male and the total white female populations were age adjusted (U.S. population, 1950) to correct for differences in the age distributions of the populations of the 10 cities. The age-adjusted rates, together with the latitudes of the cities, are given in table 1. In figure 1 these data are plotted on a semilogarithmic scale with least-squares-fitted straight lines drawn to indicate the relationship between latitude and skin cancer incidence rates. The slopes of the two lines are not significantly different, but at any latitude the rates for white males are higher than those for white females.

Age-specific incidence rates for the white male and white female populations in the 10 cities studied are shown in tables 2 and 3. In figure 2, these data are plotted semilogarithmically against the latitudes of the cities, and straight lines are fitted to the plots. No significant difference exists between the slopes of any of the lines. The data for the age group 75 years and older are not plotted since the groups in the various cities are dissimilar. The data for the age groups under 25 years are not plotted because the incidence rates are low and show marked variations. The broken line in the chart for females (aged 55–64 years) rep-

Table 1. Geographic latitude and skin cancer incidence rates per 100,000 population [1] for white males and females, 10 cities of the United States, 1947 or 1948

City	North latitude (degrees)	Incidence rate	
		White male	White female
New Orleans	29. 95	123. 2	68. 7
Dallas	32. 78	164. 4	95. 6
Birmingham	33. 35	182. 2	132. 3
Atlanta	33. 75	110. 0	82. 9
San Francisco	37. 77	97. 1	68. 0
Denver	39. 73	86. 3	60. 6
Philadelphia	39. 95	41. 3	32. 8
Pittsburgh	40. 43	43. 0	32. 5
Chicago	41. 87	25. 3	22. 4
Detroit	42. 33	33. 6	24. 2

[1] Rates are age adjusted.

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resents a correction for what seemed to be an incorrect point. In the reported data the incidence rate for white females aged 55–64 years in New Orleans was less than the incidence rate for white females aged 45–54 years. Such a decrease was not noted in any other age group, male or female, in any other city. The broken line was obtained by omitting this point.

The parallelism of these fitted lines indicates a constant rate of increase in the incidence of skin cancer with decreasing latitude; that is, in the white population, skin cancer rates become higher as one draws closer to the equator. This constant rate of increase appears to be independent of age or sex since all the lines, whether for males or females, are of similar slope. From

Figure 1. Age-adjusted skin cancer incidence rates for white males and females by degrees of north latitude, 10 cities of the United States, 1947 or 1948

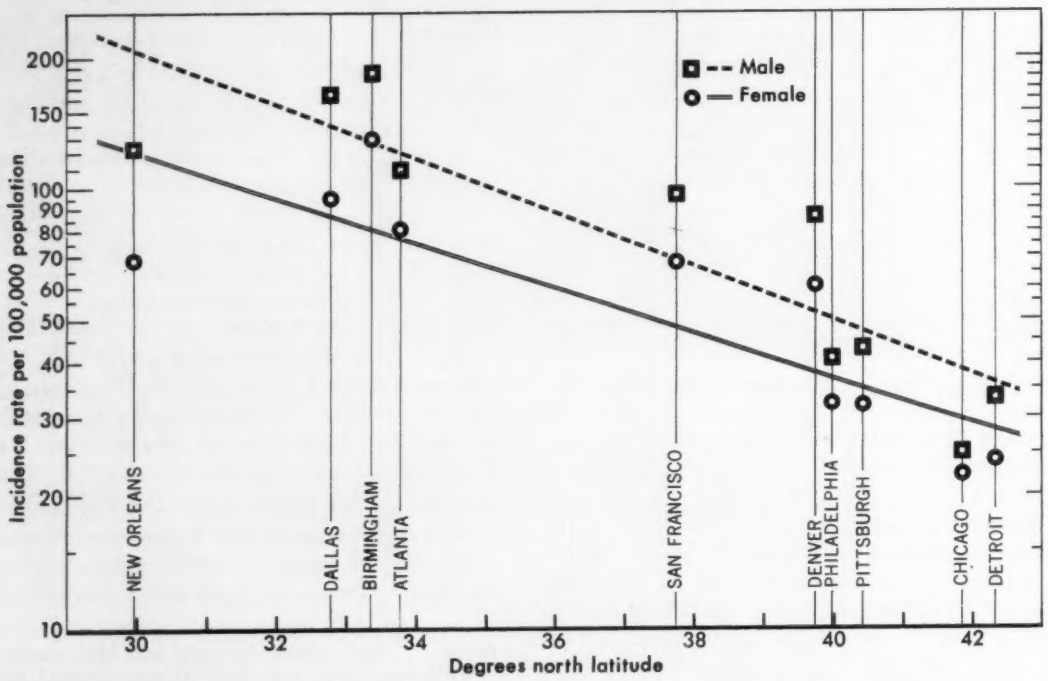


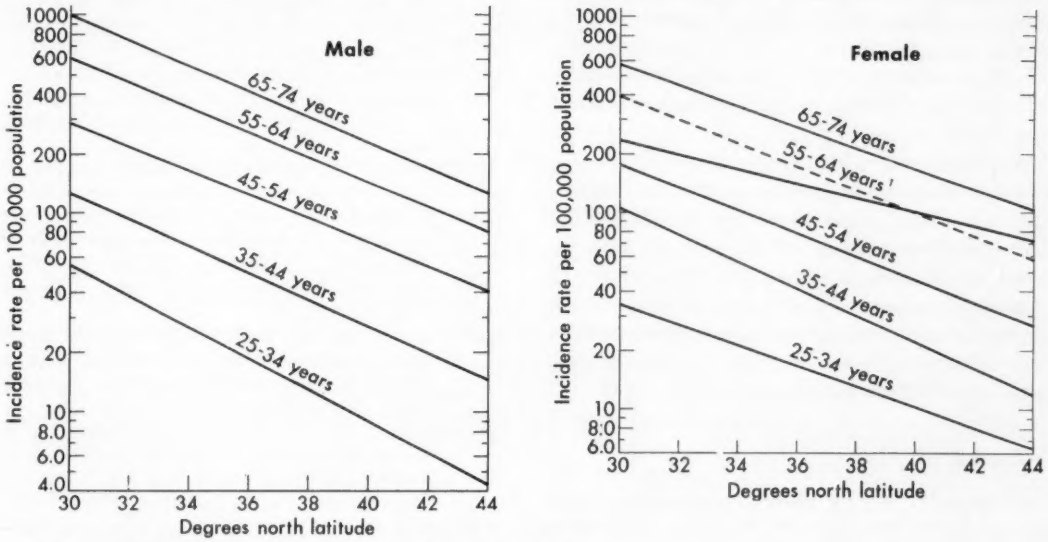
Table 2. Skin cancer incidence rates per 100,000 population for white males, by age group, 10 cities of the United States, 1947 or 1948

City	Age group (years)								Total
	0–14	15–24	25–34	35–44	45–54	55–64	65–74	75 and over	
New Orleans	7.2	3.6	40.7	52.6	139.4	456.7	568.5	704.0	111.8
Dallas	0	11.9	66.7	106.2	253.5	472.4	725.7	985.0	138.1
Birmingham	0	0	17.7	98.5	314.4	552.2	904.4	1,142.1	149.0
Atlanta	0	2.3	22.5	76.3	151.4	259.4	616.8	803.9	86.2
San Francisco	0	4.6	20.5	56.9	137.8	239.0	438.6	938.2	108.5
Denver	1.6	2.8	16.5	48.0	131.7	288.6	371.2	558.8	85.3
Philadelphia	0	2.5	8.9	25.8	56.0	94.7	194.1	405.1	42.7
Pittsburgh	1.8	1.0	8.8	21.9	50.1	136.9	168.1	417.1	41.3
Chicago	0	1.1	4.3	13.2	58.0	68.2	114.2	226.9	25.3
Detroit	.8	1.4	4.0	17.3	44.6	105.9	146.9	287.2	30.1

the fitted lines it can be estimated that skin cancer incidence rates in the white population of the United States are doubled for each 3°48′ of latitude, or approximately 265 miles. In the absence of exact measurements of the amount of ultraviolet energy arriving at the earth's surface in each of these cities, Blum (*2*) has shown that the total energy of solar radiation received at points in the United States increases at a constant rate with decreasing north latitude, that is, the farther south the area, the greater the energy received. The displacement of the plotted points from the fitted line may be due to lesser variables such as altitude, skin susceptibility due to ethnic background of the populations, degree of air pollution, and variations in diagnosis and reporting.

The differences in male and female incidence rates may be explained by differences in amount of exposure to ultraviolet radiation. Above age 35 years the male rates are invariably higher than the female rates. Such increases in male

Figure 2. Age-specific skin cancer incidence rates for white males and females by degrees of north latitude, 10 cities of the United States, 1947 or 1948



[1] Corrected for apparently inaccurate figure for New Orleans.

Table 3. Skin cancer incidence rates per 100,000 population for white females, by age group, 10 cities of the United States, 1947 or 1948

City	Age group (years)								Total
	0–14	15–24	25–34	35–44	45–54	55–64	65–74	75 and over	
New Orleans	0	0	29.8	67.9	111.1	108.2	267.0	534.3	70.7
Dallas	0	12.5	29.0	63.7	137.5	186.1	492.8	609.2	82.5
Birmingham	4.5	14.0	19.7	92.7	147.4	315.3	624.7	1,018.9	108.9
Atlanta	0	4.4	17.6	56.3	92.0	214.1	452.0	494.5	70.5
San Francisco	1.7	8.2	25.1	54.6	96.0	174.9	278.8	374.3	79.1
Denver	1.7	10.6	18.0	32.4	64.2	206.4	219.5	403.6	61.6
Philadelphia	1.1	3.2	7.6	14.4	46.3	77.3	157.3	240.6	36.1
Pittsburgh	1.9	.9	10.8	21.2	49.0	73.2	125.3	251.1	30.7
Chicago	.5	.4	5.7	10.7	25.4	65.7	94.1	179.8	22.1
Detroit	1.6	1.3	6.5	14.9	21.2	60.9	120.1	182.1	20.1

rates over female rates have been explained by Dorn (*14*) and Katz and co-workers (*15*) as due to increased exposure to sunlight or other environmental causes. Below age 35 years, however, the male rates may be higher than, equal to, or lower than the comparable female rates. This finding may reflect increased exposure to sun for girls and women as a result of changes in modes of dress and increased employment outside the home in the last 20 years.

Summary

The relationship between exposure to sunlight and the production of skin cancer is well known. From data available for 10 cities in the United States, a quantitative inverse relationship can be shown between skin cancer incidence rates for the white population and the degree of latitude of the cities.

A constant rate of increase in skin cancer incidence is observed as white populations farther south in the United States are studied. The same rate of increase of skin cancer with decreasing latitude is shown for white male and female populations and for each 10-year age group from 25 through 64 years. The incidence rate is doubled for each 3°48′ of latitude (approximately 265 miles).

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Eating Patterns Among Migrant Families

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IN THE RICH farming area of Palm Beach County, Fla., near Lake Okeechobee, an estimated 20,000 migratory agricultural laborers harvest winter vegetables from November through May. During the summer months the majority travel up the Atlantic Coast, working on farms as far north as New York State.

The nutritional status of this group is affected by their cultural background, inadequate knowledge of the nutritive value of foods, and economic problems arising from low and irregular income and the pressure of large families. Methods of preparation and preservation of food and the kind of cooking facilities used are influenced by the type of housing available to them. Their choice of foods, methods of preparing meals, and likes and dislikes are similar to those of other Negro groups in southern States (*1*).

The Project

The Palm Beach County Migrant Project was designed to develop public health techniques adaptable to the cultural and social patterns of migrant workers and to demonstrate the effectiveness of a multidisciplinary approach to the health needs of the workers at the Okeechobee migrant labor camp in Belle Glade, Fla.

The project team was composed of two public health nurses, a sanitarian, a health educator, a medical social worker, a nutritionist, a liaison worker, and a secretary. A pediatrician and a general practitioner provided part-time health services.

Plans for a dietary study on a selected group of families were prepared by the project team nutritionist, in collaboration with the director of nutrition services of the Florida State Board of Health and the regional nutrition consultant for the area. The objectives of the study were:

- To obtain information concerning the eating habits, buying practices, food customs and beliefs, nutritional adequacy of the diet, and the general nutritional status of the study group.
- To secure data that would provide a basis for discovering practical and usable educational techniques in nutrition.
- To use certain educational techniques in giving information about nutrition.
- To evaluate the techniques used.

This paper reports on the data obtained on eating habits, buying practices, food preparation, nutritional adequacy of diet, and nutritional status of a selected population in the project area. Subsequent reports will deal with other aspects of the study, including a 3-day dietary study of the children of the selected families.

The Study Population

Most of the workers at the Okeechobee migrant labor camp are American Negroes from Georgia and Alabama. They spend approximately 7 months a year at the camp, living in

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The project was financed by the Children's Bureau and administered by the Palm Beach County Health Department, under the supervision of the Florida State Board of Health.

wooden, concrete, or tin houses of from one to three 12- by 16-foot rooms. Their children attend the elementary school at the camp.

Because of limited time and staff, only 35 of the 350 families living at the camp were selected for the study. These families had been in the migrant labor stream for some time, had school-age children, and had attended the well-family clinic at the Belle Glade Health Center.

The objectives of this well-family clinic are to determine the health status of the migrant group and the extent to which they will accept preventive health services. In selecting families to be invited to attend the clinic, the health center endeavors to obtain a cross section of the migrant community. The only specific requirement is that no obvious major health problems exist in the families selected. A fairly complete health history and evaluation of each family participating in the study was available to the migrant project staff.

Forms and Records

A 24-hour recall diet record, a food inventory form, and a general information form were used to obtain information on the nutritional status of the study families. Information for the 24-hour recall record was obtained from the mother or other person responsible for planning and cooking the meals. A set of interview forms was pretested with one family to determine whether or not they understood the questions.

Five forms were developed for evaluating the data: record of intake of food groups, to show the average daily and weekly intake of food for each family; calculation of food intake, for analysis of nutrients; cost analysis form, to provide a cost breakdown of the foods purchased; weekly food plan, to show the food needs of both children and adults; and food-pricing record, to show average prices for the area.

Interviewing Procedure

The project nutritionist obtained the assistance of the migrant project nurse responsible for the Okeechobee camp and the migrant project liaison worker in helping to explain the purpose of the study to the families.

Detailed information on foods eaten was obtained through home interviews. All interviewing was done by the nutritionist of the migrant project. Six families were seen each week, starting with three families the first week. Each family was visited three times. Those seen on Monday morning were revisited the middle of the week and again on the following Monday morning. The same procedure was followed with families seen first on Tuesday, Wednesday, Thursday, Friday, and Saturday. Each day a new family was added to the ones visited a second time.

The initial visit was devoted to a brief explanation of the study, establishment of confidence and rapport, starting the general information form, and beginning the food inventory and 24-hour recall record. The general information form was completed during the second and third visits. The inventory was checked at the midweek visit and completed at the last visit.

As a rule, the families were helpful and cooperative. They showed the nutritionist all groceries on the shelves and in the refrigerator or icebox, the dishes, silverware, and cooking utensils.

Except in three families, the mother was the person interviewed. In these families, the older daughters were interviewed because the mothers were working and the daughters were cooking the meals. The 24-hour recall and general information forms were filled out during informal conversations. The interviewer tried not to ask too many questions but rather led the mother or daughter to discuss meals and food preparation themselves.

Cooking Schedules and Foods Eaten

The 24-hour diet recall and general information records showed that most families cooked twice a day when they were all working and three times a day when the mother stayed at home. Usually they carried some of the food from the morning meal to the field and reheated some of it when they came home late in the afternoon. They cooked meats, such as chicken, pork chops, ribs, sausage, or fish, very early in the morning. All cooked grits in the morning and sometimes rice, biscuits, cornbread, and potatoes. Most families had eggs, along with the grits, and fried white bacon or sausage.

The following examples give the daily menus for families cooking twice and three times a day:

Cooking Done Twice a Day

Breakfast (6:00 a.m.): Fried chicken, rice, gravy, biscuits, sausage, and grits.

Lunch (11:30 a.m.):

Adults (in the field): Cookies or sandwich and soft drink.

Children (at home): Spaghetti, 1 can for 4 children; milk, ½ pint per child.

Dinner (7:00 p.m.): Black-eyed peas with white bacon, rice with neckbones, and white bread.

Cooking Done Three Times a Day

Breakfast (6:00 a.m.): Grits, eggs, white bacon, toast, and butter.

Lunch (11:30 a.m.): Stew meat, rice, snap beans, white potatoes, light bread, and cola drink.

Dinner (7:00 p.m.): Spareribs, macaroni and cheese, light bread, and chocolate milk.

Women who were heads of households said they cooked a large breakfast so that they could stay longer in the field without eating too much lunch. Sometimes they bought fish sandwiches, hot dogs, cookies, peanut and chocolate candy, and soft drinks at the field, and some carried cooked food to eat there. For small children remaining at home or attending school, the mothers left canned foods, such as pork and beans or spaghetti, and bread, cold cuts, peanut butter, mayonnaise, and jelly for preparing sandwiches. Sometimes the children heated some of the food cooked in the morning and ate it at lunchtime.

For the evening meal most families ate cornbread, black-eyed peas with bacon or pigs' feet, and vegetables such as peas, cabbage, and corn. Beverages prepared from commercial powders, iced tea, and small amounts of milk were served at this meal. Neckbones and pigs' feet, ears, and tails were eaten almost every day.

Canned tomatoes, peas, and corn were used to some extent. The most common fresh vegetables were green beans and cabbage. Turnip greens and collards were grown in small gardens around some of the houses. Canned foods such as spaghetti, pork and beans, beef stew, and chicken were popular. Spiced ham, peanut butter, mayonnaise, and jelly sandwiches were consumed mostly at lunchtime. Crackers, sweet cookies, sweet rolls, and soft drinks were also used to a large extent for lunch and between meals. Rice and white bread were used extensively.

The fresh fruits most commonly seen were bananas, grapes, and apples. Canned peaches were well liked; dried prunes were seen on rare occasions. Citrus fruits were used whenever economic conditions would permit. Some families used canned grapefruit and orange juice, and some bought tangerines, oranges, and grapefruit when they were in season and prices went down. Citrus fruit is not grown plentifully in this section and is often available only in stores.

Very little milk was purchased. Fresh homogenized milk was consumed in small quantities, and some buttermilk was used. Dry skim milk was used by families who had been taught its value. Evaporated milk was used mostly for infant formulas. Cheddar cheese was eaten in small amounts.

Dried lima beans and black-eyed peas were the most common legumes eaten. Red kidney beans, pinto beans, and great northern beans were used less commonly and only by a few families. Grits were the favorite cereal and were eaten daily, often two or three times a day. Next in order of consumption were rice, oatmeal, and dry cereals, such as cornflakes. Dry cereal might be eaten in the morning or between meals.

Sliced white bread was popular and, because of lack of time for baking, other ready-prepared breads were widely used. Cornmeal and self-rising flour were used in preparing breads at home. Occasionally the diet included biscuits and commercial or homemade cakes and pies.

Margarine, butter, lard, vegetable shortening, oil, and mayonnaise were used for frying and for preparing various dishes. Jellies, preserves, and marmalades, and sugar, sirup, candies, and soft drinks were almost always included in the weekly grocery lists. Coffee, tea, and cocoa were sometimes used, but powdered and soft drinks were preferred.

Buying Practices and Food Preparation

The majority of the families shopped for groceries on Saturday. A few mentioned Friday and Sunday as days to shop. The mothers

and older daughters usually bought the groceries, but sometimes the husbands and older sons did the shopping. Many families traded in chainstores when money was available. When money was scarce, they traded in small stores at the housing camps or at farms on credit. The families with refrigeration shopped weekly; the one without refrigeration shopped daily. A few vegetables, such as beans, cabbage, celery, and corn, were obtained free from farms or from small gardens close to home.

The women usually did the cooking, although on rare occasions their husbands helped. Frying and barbecuing were the most common methods of cooking meats and fowl. Vegetables and legumes, such as dried lima beans and black-eyed peas, were cooked in water with ham hocks, white bacon, pigs' feet, ears, tails, or neckbones for added flavor. Neckbones were a preferred food. Cornbread and hoecake made from self-rising flour were cooked almost daily in skillets on top of the stove. Biscuits were baked in small portable ovens on top of the stove. Cakes and pies were baked on Saturdays and Sundays.

Association with other cultural groups—Jamaicans, Bahamians, Cubans, and Puerto Ricans—has brought new ideas in food preparation to these families, and some of them had learned to prepare new dishes from these other groups.

Kitchen Equipment

Thirty-four families had some kind of refrigeration: 29 owned electric refrigerators that they themselves had purchased; 5 had iceboxes provided by the housing project. Twenty-four families had bottled-gas stoves with ovens, and 11 had 3- or 4-burner kerosene stoves, 3 of them equipped with small portable tin ovens.

All the families owned dishes, glasses, cups, silverware, cooking spoons, eggbeaters, percolators, dishpans, buckets, and can openers. Drawings of serving spoons and plates were made by the interviewer to get an idea of the size of food portions consumed by various members of the family. Servings varied in size. Plates and serving spoons of various sizes were used. Some families used a large cooking spoon for serving food, while others used a tablespoon.

None of the homes had running water inside the house. Water for drinking, cooking, dishwashing, and other household purposes was obtained from faucets outside the house and was carried in by male members of the family. The water was kept in buckets, frequently with a dipper inside which was used as a drinking cup by all members of the family.

Evaluation of Diets

The family diets were analyzed on the basis of food values given in the food composition tables of the U.S. Department of Agriculture

Table 1. Percentage of families meeting National Research Council nutrient allowances

Nutrient	Fraction of allowances met				
	Total	¾	½–¾	Below ½	None
Calories	20	40	34	6	0
Protein	37	11	46	6	0
Calcium	14	8	52	26	0
Iron	34	23	26	17	0
Vitamin A	32	0	26	42	0
Thiamine	42	29	23	6	0
Vitamin C	3	11	17	66	3
Riboflavin	20	20	34	26	0

Table 2. Percentage of families meeting U.S. Department of Agricultural Allowances, by food groups

Food group	Fraction of allowances met				
	Total	¾	½–¾	Below ½	None
Milk	0	0	3	97	0
Green and yellow vegetables	0	0	0	37	63
Citrus fruits and tomatoes	2	8	8	48	34
Potatoes and sweet potatoes	5	5	8	14	68
Other fruits and vegetables	2	12	6	60	20
Meats, poultry, fish	43	38	8	11	0
Dry beans	94	2	2	0	2
Eggs	8	2	14	74	2
Flour and cereals	80	15	0	5	0
Fats and oils	88	8	2	2	0
Sugar and preserves	66	23	5	3	3

(*2*) and "Food Values of Portions Commonly Used" (*3*). In a large percentage of the study group, consumption of certain nutrients was below half the amounts recommended by the Food and Nutrition Board of the National Research Council (*4*). Among these were vitamin C, in 69 percent of the families; vitamin A, in 42 percent; and riboflavin and calcium, in 26 percent. In only 6 percent, however, did the protein and calorie consumption fall below half the recommended allowance (table 1).

In evaluating the diet (*5*), it was found that 22 families (63 percent) ate no green or yellow vegetables, and 13 families (37 percent) ate less than half the recommended allowance. Seventeen families (48 percent) fell below half the recommended allowance in consumption of citrus fruits and tomatoes, and 12 families (34 percent) ate nothing from this food group. Thirty-four families (97 percent) fell below half the recommended allowance for milk and milk products (table 2).

Food Costs

A price record was kept of foods bought from a large store and from a small store patronized by the study families. Prices were collected in the two stores during the period February–April 1959. An average cost was computed and a cost analysis of the diets was made (table 3). From $18 to $22 per week, about half their weekly earnings, was spent for food by the 18 families which had from 7 to 9 members each. According to Department of Agriculture standards, from $35 to $47 would be required to feed families of this size a low-cost adequate diet. However, this would mean that all food would be purchased, whereas some of the food eaten by the study families was obtained without cost, for example, food which was brought home from the fields.

Medical and Dental Findings

No physical examinations were made as part of the nutrition study, but reports of examinations made in the health department clinics showed an apparent relationship between the dietary and medical findings. Families with lower intakes of necessary nutrients had diagnoses of rickets, marasmas, kwashiorkor, obesity, emaciation, nutritional anemia, and malnutrition, as compared with persons in the remainder of the group. Many of the children in the families with lower intakes of nutrients were pale and underweight, and eight adults were markedly obese. Two women gave a history of miscarriages.

A detailed dental study of both adults and children by the bureau of dental health, Florida State Board of Health, revealed that 84 percent of the persons examined had dental caries, and 35 percent had lost permanent teeth.

The dental study also showed 40 persons with dry and cracked lips, 14 with spongy gums, 27 with gums that bled easily, 21 with slight gingivitis, and 16 with signs of severe gingi-

Table 3. Summary of information on 35 migrant families,[1] Okeechobee migrant labor camp, Belle Glade, Fla.

Number of families	Members per family	Age range of children	Number rooms in home	Average weekly earnings	Average weekly expenditure for food
2	12	2 yrs.–20 yrs	2	$40	$32
2	11	6 mos.–18 yrs	2	40	20
4	10	8 mos.–18 yrs	2	40	33
5	9	2 yrs.–14 yrs	2	47	22
8	8	1 yr.–20 yrs	2	43	19
5	7	1 yr.–13 yrs	1	36	18
2	6	3 yrs.–22 yrs	1	76	18
5	5	1 yr.–13 yrs	1	44	15
1	4	10 yrs.–12 yrs	1	30	10
1	3	11 yrs	1	54	17

[1] Both husbands and wives work in the fields; the men sometimes engage in construction work. The wages vary at certain times.

vitis. These findings indicate a definite relationship between dental caries and problems of the gums and lips and a low intake of protective foods.

As stated in the clinic records and by the mothers at the time of interview, most of the babies and children had been taking vitamin preparations on prescription from an early age.

Comments

Although the study group was composed of only 35 of 350 families in a Negro population with migratory characteristics, in all probability their eating habits and nutritional problems are similar to those of cultural groups of the same racial characteristics and economic and social conditions living in camps in other areas. The families studied may be somewhat above the average since they were selected from among the apparently well families included in the family clinics. They had been exposed to education as to dietary and other measures they might take to keep well, and were "educable," as indicated by their acceptance of clinic care.

The most common diet deficiencies revealed by the study were low intakes of milk, green and yellow vegetables, citrus and other fruits, eggs, and white and sweet potatoes. Legumes and meats were eaten in fair quantities; sweets, fats, and flour consumed were above the recommended amounts in some cases.

Fish were well liked and were a good source of protein, and they could be had at no cost to families who enjoyed fishing. Pork chops, ham, and steak were eaten when money to buy them was available. Pointing out differences between prices of these and other items could be helpful in teaching the group to use the more expensive foods in lesser amounts, and to purchase cheaper sources of protein. This would leave money for such foods as citrus and other fruits, green and yellow vegetables, including sweet potatoes, and milk, which were consumed in amounts below recommended allowances.

Since buttermilk was well liked, the use of dry skim milk to prepare it could be stressed. The possibilities of using dry milk powder with other familiar foods, such as adding it to cornmeal for making cornbread, to hamburger meat, and to chocolate powder or juices that are liked by the children should also be encouraged.

The high consumption of fats, sweets, flour, and soft drinks could be responsible in part for the obesity of some adults in the study group.

The need for education concerning nutrition and basic health is evident. However, consideration should also be given to housing, cooking equipment, hours of work in the field, time spent at home, number of children in the family, earning capacities, rental expenses, utilities, and transportation facilities, which directly affect an education program in health and nutrition. The amount of money available for food indicates that very careful planning and budgeting are necessary if migratory families are to have adequate diets. Since none of them showed evidence of planning ahead, it will take persistent efforts over a period of time to bring about changes in their buying habits.

These families need basic information on all aspects of nutrition and food preparation, and this can only be achieved by a well-rounded, integrated program, with all agencies, both official and voluntary, which deal with these families working toward improvement of their health, educational, and social conditions. These agencies would include the health department, the schools, the agricultural extension service, and the welfare department.

Summary

A study of the diet patterns of a group of Negro migrant families living in a labor camp in Belle Glade, Fla., revealed a lack of certain groups of protective foods. It also pointed up the need for better use of the foods available and for a wiser selection of foods purchased in relation to the amount of money spent.

The most significant findings of the study were the following:

1. Low consumption of milk and milk products. However, due to the extensive use of self-rising flour, the calcium content of the diets was higher than expected. Riboflavin content of the diets was low.

2. Low consumption of green and yellow vegetables and low vitamin A content of the diets.

3. Low consumption of citrus and other fruits and low vitamin C content of the diets.

4. Greater consumption of proteins than of the above-mentioned groups of foods. However, the amounts of animal protein eaten by the larger families were too small to meet the dietary requirements for the family as a whole. Legumes were consumed in amounts above those recommended by the Food and Nutrition Board of the National Research Council. This raised the iron content of the diets.

5. Consumption of starches, fats, and sweets in excess of the recommended amounts. However, the calorie allowance in the diets of 80 percent of the families is low.

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(*2*) Watt, B. K., et al.: Composition of foods—raw, processed, prepared. Agriculture Handbook No. 8. Washington, D.C., U.S. Government Printing Office, 1950.

(*3*) Bowes, A. D., and Church, C. F.: Food values of portions commonly used. Ed. 8. Philadelphia, College Offset Press, January 1956.

(*4*) National Academy of Sciences-National Research Council: Recommended dietary allowance. NAS–NRC Pub. No. 589 (Revised). Washington D.C., U.S. Government Printing Office, 1958.

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Training Courses

Dental Education. A short course for clinical dentists employed in public health agencies will be offered at the University of North Carolina School of Public Health from July 24 to August 4, 1961. Additional details may be obtained from Charles M. Cameron, Jr., M.D., University of North Carolina, Chapel Hill.

Medical Care Administration. The University of Michigan School of Public Health is conducting a training institute on Administration of Medical Care for the Needy from July 10 to July 21, 1961. Collaborating in this institute are the School of Social Work of the University of Michigan, the American Public Welfare Association, the American Public Health Association, the Bureau of Public Assistance of the Social Security Administration, and the Public Health Service.

The institute is designed for State and local public welfare and public health personnel with administrative responsibility for the needy. Together they will study the planning, administration, and evaluation of these programs; discuss the relationships of these programs to community health services and medical care programs for the entire population; explore ways by which health and welfare departments may work together; and consider new approaches to the provision of medical care.

Additional information may be obtained from S. J. Axelrod, M.D., University of Michigan School of Public Health, Ann Arbor.

Hospital Administration. The Sloan Institute of Hospital Administration at Cornell University will hold its fourth annual Hospital Administrators Development Program from June 25 to July 21, 1961.

The 4-week program will consist of an intensive course of lectures, readings, and discussions divided into three seminars dealing with medical care, the administrative process, and trends in hospital administration.

Participation will be limited to about 25 persons selected from among the applicants. Total cost to participants will be $100, including tuition, supplies, room, and most of the meals. Additional details may be obtained from Prof. Frederic C. LeRocker, director, Sloan Institute of Hospital Administration, Cornell University, Ithaca, N.Y.

Water Pollution Conference. Public health hazards of microbial pollution of water will be the subject of the Rudolphs Research Conference at Rutgers University, June 19–21, 1961. Three sections of the conference will deal with the public health problem, indicator organisms and their significance, and disinfection—theory, objectives, and accomplishments. For further information communicate with Dr. H. Heukelekian, Chairman, Department of Sanitation, Rutgers University, New Brunswick, N.J.

Program Notes

Nearly three-fourths of Baltimore families who need "mother substitutes" during the day use relatives or workers who come into the home. Approximately 20 percent of these families arrange out-of-home care with a relative or at a private home; only 1 in 34 families use day nurseries. The city health department recommends that health information for mother substitutes should reach relatives and day workers who provide such care.

« »

The American Hospital Association has urged its 6,500 member hospitals to adopt a uniform drug formulary system for prescribing drugs by their generic names rather than by trade names. The action was taken by the AHA House of Delegates at its last convention.

« »

The sale of potassium permanganate without prescription was banned by the Food and Drug Administration effective October 23, 1960. The action was taken after reports in medical journals revealed more than 1,000 cases of misuse of the drug in attempted abortions.

« »

The sale of raw milk for public consumption has been banned by New York State beginning April 1, 1961.

« »

A 4½-year study of 800 pupils in the first four grades of two schools in Baton Rouge, La., reported by Dr. Louis L. Rusoff, nutritionist at the State university, revealed children who drank a half-pint of fluoridated milk a day had 76 percent fewer cavities. The benefit showed in permanent teeth which appeared after the children began drinking fluoridated milk.

Since persons over 60 and children 6 and under accounted for more than half of the fatalities in the District of Columbia in 1960, the Department of Motor Vehicles is planning educational programs directed at these age groups. The campaign includes posters, radio announcements, traffic death scoreboards, and safety films.

« »

All major health and welfare agencies in Monroe County, Rochester, N.Y., have a countywide home care plan providing comprehensive nursing, social, rehabilitative, and other supportive services to patients at home under direction of their private physician.

Proceedings of the Workshop on Home Care Programs, jointly sponsored by the American Hospital Association, American Medical Association, Public Health Service, Blue Shield Medical Care Plans, and Blue Cross Commission, are available for $1 a copy.

« »

The 1960–61 "Directory of Social and Health Agencies of New York City" has been released by Columbia University Press. The publication provides comprehensive but brief information about welfare and health agencies serving New York City and includes civic, educational, and religious organizations if they offer services in social welfare or closely related fields.

« »

Bucks County is the first in Pennsylvania to develop a master plan for present and future sewerage and water needs.

Municipalities in the State have been notified that it is unlawful to construct sewers without a prior permit from the Sanitary Water Board.

Pennsylvania is the first State to require its 5½ million drivers, and all new applicants, to pass periodic physical examinations to hold their licenses. Each year 750,000 drivers will be picked at random for examination. The program will take 10 years to complete.

« »

The second issue of *Medicine at Work* is devoted to a crusade against cacography (poor handwriting).

« »

An information booklet for speakers at the New York State Annual Health Conference to be held in Rochester, N.Y., June 5–8, 1961, requests two copies of papers 3 weeks in advance so that the text may be "accurately quoted."

« »

W. W. Towne, chief of field operations for the PHS Sanitary Engineering Center, estimates there are more than 1,000 sewage lagoons in operation throughout the Nation "without threat to community health."

« »

Nine nations have lower infant death rates than the United States. Sweden is lowest with 15.8 deaths per 1,000 children under 1 year, followed by the Netherlands, Australia, Norway, and Switzerland. In 1958 the United States had 27.1 infant deaths per 1,000 live births.

« »

Safety seat belts have been offered by Chrysler Corporation to its dealers on a nonprofit basis with the recommendation the belts be made available to owners of all makes of cars on a similar basis.

New York State showed injuries and deaths were 60 percent lower in 400 automobile accidents involving people using seat belts than in 400 similar accidents where seat belts were not used.

At least 100 employees of the U.S. Forest Service have been saved from death or serious injury because they were using the belts.

County Psychiatric Emergency Services

W. ROSS CAMERON, M.D., M.P.H.

THE NEW and more effective techniques for treatment of mental illness which have become available in recent years have stimulated some county health administrators to increase their efforts to discontinue detention in jail of mentally ill persons awaiting commitment to a State hospital.

Until the spring of 1959, Washington County, Md., residents who became violent or exhibited bizarre behavior were held in the county jail to await completion of hospital admission forms. Many persons were held for long periods while commitment certificates were obtained from two physicians and the patient's legal residence and the family's ability to pay were determined. Lack of hospital space sometimes further delayed the patient's admission to the hospital.

In 1958 county leaders had attempted unsuccessfully to obtain emergency care for mentally ill patients in a local general hospital, a State chronic disease hospital, a church-owned hospital for care of the mentally ill, and several private nursing homes. In the spring of 1959 a committee appointed by the county commissioners to obtain temporary care for mentally ill patients again approached these institutions, but their efforts also were fruitless.

Therefore, the commissioners requested the writer to organize an emergency service that would end jail detention of the mentally ill, except mentally ill persons charged with violation of law and the rare patients who could not be taken directly to a State hospital. On May 5, 1959, the commissioners approved the plan outlined below.

Emergency Service

All requests for aid in dealing with what is thought to be mental illness are to be telephoned to the county health department, day or night. During the day emergency calls are received in the health department. After business hours and on Saturdays, Sundays, and holidays, a telephone service receives all messages and transmits them to the health department personnel who are on call. If the sheriff's office is called first, as has long been the custom, the call is to be referred to the health department. However, if the sheriff has reason to believe that his services are needed, he may go to the scene after asking the health department to dispatch medical aid.

If a physician desires assistance for a patient, he may call the health department, which is prepared at all times to aid in obtaining prompt hospital admission or psychiatric evaluation in the local mental health clinic.

In response to each emergency call, a health department physician and a nurse, preferably one with psychiatric training, are to go to see the patient. If the patient is reported particularly menacing or unmanageable, one or more deputy sheriffs may be asked to accompany the emergency team.

If the investigating physician believes the patient should be hospitalized immediately, he may give appropriate treatment and take steps to expedite the commitment routines. As soon thereafter as practicable, the patient is to be taken directly to a State hospital.

At night or on a holiday, every reasonable and proper effort is to be made to delay admission of the patient to the State hospital until the full staff is on duty.

If health department investigators find that the case is not an acute emergency, treatment may be prescribed and the patient referred for

Dr. Cameron is deputy State and county health officer, Washington County, Hagerstown, Md.

examination at the next session of the local mental health clinic. The clinic is open Monday, Tuesday, and Saturday of each week.

Experience Under the Plan

The emergency service has been functioning a little more than a year. The 100 cases investigated to date have included the following:

- An individual who insisted on stepping in front of automobiles as they entered an intersection.
- A man who had accumulated guns and ammunition in his home and threatened to shoot anyone who approached.
- A man, arrested for a serious traffic violation after his car crashed into a tree, who was found to be mentally disturbed. (Did the mental condition exist before the incident or was it a result of the accident?)
- A husband who on two occasions attempted to kill his wife with a pair of scissors.
- A person perched on the edge of a high building who repeatedly threatened to jump.

No two cases were exactly alike, although patterns appear to be emerging. Each case presented a challenge, if not an adventure, and from experience with these and other cases we hope to learn how best to manage abnormal persons.

Although the number of cases investigated is too few for statistical analysis, they have provided a variety of experiences. Important lessons have been learned and observations have been recorded that may be of value to others. These are summarized below.

There is no substitute for a visit in the patient's home. In a few minutes in the home, an experienced observer can gain more pertinent information about the patient and his environment than can be gained during hours of probing in an office, using miles of recording tape and hours of typing time.

It is advantageous to have both a physician and a nurse answer each call. In most emergencies one must deal with a disturbed patient and with his distraught family. In Washington County, one member of the health department team, usually the physician, deals with the patient while the nurse discusses the situation with members of the family. The physician, the nurse, and the family then confer until agreement is reached as to the most appropriate action to be taken.

On many calls the emergency team has been accompanied by the sheriff and one or more of his deputies or by one or more policemen from Hagerstown, depending on the place of residence of the patient. From these experiences we have developed a deep sense of appreciation of the courage, skill, and devotion to duty of local officers of the law.

Better results are obtained when a psychiatrist serves as the physician member of the emergency team. A psychiatrist usually can identify rather quickly the patients who are better suited for clinic care; he is able in a short time in the home to obtain a great deal of information that aids him in evaluating the patient and in planning for his treatment; and he is much better qualified to make decisions of this kind than the general practitioner or health officer.

At present two part-time psychiatrists are available 3 days each week. Ultimately, we hope to employ a full-time specialist in this field. Meantime, we are endeavoring to defer decisive action on as many cases as possible until each case can be screened by a psychiatrist.

It is important that a responsible member of the family accompany the patient to the hospital and to the clinic. In most cases only a close relative can provide the information needed to complete the patient's history and establish a link between the institution or clinic and the family.

Of the first 100 "emergency" cases 34 either were not in need of hospitalization or a decision was deferred until a clinic study could be completed. In many instances, obvious signs of mental illness had been noted by members of the family long before the emergency arose. In these cases, there is no record of serious efforts to obtain psychiatric evaluation of the patient, although psychiatric service has been available in the community for many years.

Modifications of the Program

Since its inception several modifications have been made in emergency service for mentally ill patients.

Routine psychiatric screening of all cases reported to be in need of care in a State hospital has been instituted. School children are examined by the health department's pediatric consultant or are referred to the mental health clinic. Those classified as disturbed are separated from those classified as disciplinary problems.

Insofar as practicable, all individuals for whom hospital care is requested at public expense are screened by the psychiatric team. As a result of these procedures, a significant number of patients who otherwise would have been hospitalized precipitously are now being treated in the clinic.

Development of a more comprehensive health education program has been started. The following activities have been included in the program:

- Public education, through various media, designed to promote a better understanding of the aims, functions, and costs of the mental health program, with special emphasis on the importance of early diagnosis and treatment.
- Conferences with hospital administrators and boards of trustees. It is hoped that as a result of these conferences more rational hospital admission policies will be adopted, a psychiatric ward will be opened in each hospital, and at least one psychiatrist may be induced to engage in private practice in Washington County.
- Organization of a series of seminars for general practitioners.
- Classes for policemen, school teachers, nurses, welfare workers, and others, providing instruction in the recognition of signs and symptoms of mental illness as well as in methods of management of emergencies.

Local clinic services have been expanded. In Washington County, one part-time psychiatrist and a full-time secretary have been added to the staff of the mental health clinic.

In comparison with other clinics, operation of a mental health clinic is very costly, but the cost of hospitalization is even higher. In 1959 the average cost of care in State hospitals in Maryland was $1,679 per patient. On January 1, 1960, there were 290 Washington County residents under treatment in these hospitals. If the patient load of 290 was constant throughout the year, the total cost of hospitalization for mental illness in 1959 would be $486,910. In 1960 the cost per patient and, therefore, the total cost of hospitalization in State hospitals will be considerably higher.

It seems logical that the huge amount of money now being expended for hospital care of the mentally ill can be reduced significantly by increasing local clinic services.

A more adequate followup service for patients on leave or after discharge from a State hospital has been organized. We realize that some patients require periodic hospital care. For those who do not require such care, however, we believe that we may be able to reduce the number of readmissions to State hospitals by developing a more efficient followup service by public health nurses and by promoting periodic checkups of all clinic patients. In this way, the mentally ill can remain at home and maintain their place in the community.

Summary

In Washington County, Md., a simple and inexpensive emergency psychiatric service has been designed to prevent jail detention of mentally ill patients awaiting admission to a State hospital.

In attaining this objective, something has been learned about the management of disturbed patients in emergencies.

The service has resulted in reduction of admissions to State hospitals by 32 percent and an increase of 51 percent in attendance at the less costly local mental health clinic.

The local mental health program has been expanded to include screening of all individuals thought to be in need of hospital treatment at public expense, a more comprehensive health examination program, expansion of the local mental health clinic, and organization of a more adequate followup system for patients discharged or on leave from State hospital.

Commentary

Mental health workers for years have deplored the practice of detaining mentally ill persons in jail while they await transfer to a mental hospital. They have also deplored any unnecessary involvement of police in measures leading to the hospitaliza-

tion of the mentally ill. Many communities, however, have devised medical methods of initiating the hospitalization of the mentally ill, when necessary, which avoid involving police or jails.

The situation in Washington County, Md., as of the first quarter of 1959, probably is the rule across the Nation rather than the exception. If the service described in this paper is an indication that health departments are beginning systematically to consider the relationship between their programs and unmet needs of mentally ill persons in their communities, including acute episodes of illness which require, or seem to require, immediate hospitalization, it is indeed an encouraging sign.

The program initiated by Dr. Cameron has one unusual and highly desirable feature. This is the home visit by a physician, preferably a psychiatrist, and a teammate, when an acute disturbance suggesting mental illness occurs. In Washington County, the teammate was a nurse, but a skilled psychiatric social worker might be even more effective in aiding the psychiatrist in investigating the need for admission of patients to a public mental hospital. The method described seems to resemble that used in Amsterdam, Holland, as described by Querido.

Dr. Cameron states that hospital admissions decreased significantly during the first year of the program. This trend needs to be followed over a period of years. The experience of other communities has been that as psychiatric services improve hospital admissions increase, just as admissions of patients with tuberculosis increased as public health workers began to intensify tuberculosis control programs. With mental illness, as the public begins to accept improved psychiatric services, many cases of depression will appear in hospitals, especially in the psychiatric units of general hospitals. In the absence of adequate services, we do not know the natural history of these cases, but we need to explore the implications of the question of how many of them should be discouraged from entering the hospital, provided that inpatient treatment is rapid and effective after care is provided.

It is doubtful that further extension of the Washington County community health program will save money, as Dr. Cameron seems to suggest, especially if public funds are used to support psychiatric inpatient units in general hospitals. The type of effort described is essential, but it is misleading to advance it as a method of effecting economies. It is certain that programs of this kind will alleviate human suffering, however.

The side effects of the program are likely to be highly significant, especially if Washington County can effectively follow up discharged mental hospital patients.

Many implications of the program are not mentioned in this paper. A host of complications are yet to be faced. For example, if public health nurses are to carry the burden of followup service for discharged mental hospital patients, they will need mental health training and mental health consultation service.—HAROLD C. MILES, M.D., *director of mental health services, Monroe County Board of Mental Health, Rochester, N.Y.*

Education Note

Oklahoma's Third Heart Disease Course for Multidisciplines

HERBERT B. HUDNUT, Jr., M.D., and KIRK T. MOSLEY, M.D., Dr.P.H.

IN APRIL 1960 the third in a series of short courses on "The Heart Patient," was conducted at the University of Oklahoma Medical Center. The course has been held biennially since 1956. A report of the first course was published previously (*1*).

These 2-week courses have been co-sponsored by the University of Oklahoma Medical Center, the Oklahoma State Department of Health, and the Oklahoma State Heart Association.

Purpose

The course is designed for physicians, nurses, social workers, and other paramedical personnel. Its purpose is to increase the students' knowledge about the heart diseases and the problems these diseases present to individuals and communities.

The prevention and treatment of heart disease often require the services of a variety of medical and paramedical disciplines. Basic information about cardiovascular diseases and the programs necessary for their control must therefore be communicated to all the disciplines concerned. The course stresses a multidiscipline approach to heart disease problems.

Students and Faculty

The students in 1960 consisted of 19 nurses, 9 dietitians, and 7 social workers and vocational rehabilitation workers. Although no physicians enrolled for the entire course, a number of them attended individual sessions.

Most of the faculty participants were from various divisions of the University of Oklahoma Medical Center. Also included were representatives of the Oklahoma State Department of Health, the Oklahoma State Heart Association, the Public Health Service, the Oklahoma State Department of Public Welfare, and the Oklahoma Medical Research Foundation.

The Program

To provide variety in teaching methods and to stimulate student participation, the program offered lectures, case presentations, panel discussions, and group discussion periods.

Lectures included a review of anatomy and physiology of the circulatory system, a review of the pathology of important cardiac disorders, problems of patients with each of the major forms of cardiovascular disease, rehabilitation of stroke patients, problems in detection and prevention of heart disease, and public health aspects of heart disease. Panels discussed problems in prevention and correction of obesity, employment of patients with heart disease, and psychological and physical rehabilitation of the stroke patient.

Dr. Hudnut, medical officer in charge, heart unit, Oklahoma State Department of Health, was coordinator of the course. He is a commissioned officer on temporary active duty with the heart disease control program of the Public Health Service. Dr. Mosley, associate dean in charge of special training and research programs and professor of preventive medicine and public health at the University of Oklahoma Medical Center, was faculty chairman for the course. Dr. Mosley is now commissioner of health in Oklahoma.

There were six case presentations, which followed and illustrated the morning lecture on the problems of patients with a specific type of heart disease. Discussion of the cases by a representative of each of the major disciplines involved in the care of the patient was followed by a general discussion by the group and guest consultants. The cases provided examples of coronary artery disease, hypertension, congenital heart disease, congestive heart failure, rheumatic heart disease, and cerebrovascular accident. For each case, problems of primary and secondary prevention of the particular type of cardiovascular disease were discussed in addition to the problems of the patient.

Discussion sessions were held each afternoon for each discipline, or sometimes for several disciplines during which specific problems were discussed in more detail. For example, topics planned for the physicians were: anticoagulation after myocardial infarction, preventable forms of hypertension, analysis of experience in cardiovascular screening, and open heart surgery. The nurses gave special consideration to work simplification, rehabilitation of stroke patients, home nursing for cardiac patients, and nursing responsibilities as part of an open heart surgery team. Special topics for dietitians were low-cost meals and the use of surplus commodities, sodium-restricted diets, and variations in types of fats and proteins used in research diets. The social workers included in their discussions social problems as related to the various types of heart disease, principles of working together, principles of interviewing, and diversional therapy.

As special features there were lectures on the relation of serum lipids to myocardial infarction and on the fluorescent antibody technique and its application to the detection of group A beta hemolytic streptococci, field trips, a demonstration of the mobile screening unit of the chronic disease control division of the Oklahoma State Health Department, a variety of films related to various topics of discussion, and a lecture-demonstration by an open heart surgery team.

On the last day, community responsibilities concerning heart disease received special consideration. In a variety of ways the students were guided to relate the problems they discussed in the course to their own communities in Oklahoma and other States. One representative student from each discipline gave a report on recommendations for improving heart programs, summarizing the discussions held by the members of his discipline during the course. These suggestions have been given further consideration by the heart unit of the division of chronic disease control at the Oklahoma State Department of Health and the Oklahoma State Heart Association. In addition, many of the suggested improvements were shown to depend on individual efforts of the students when they returned to their home communities.

Discussion

The short course on "The Heart Patient" has been very successful and appears to improve each time it is given. The class of 35 students in 1960 was larger than in previous years, and enrollment was completed several weeks in advance.

Most of the students have been in paramedical professions. While a number of physicians have participated as faculty, relatively few have enrolled as students, either on a full-time or part-time basis.

There have been many indications of the value of these courses. They have significantly increased the students' knowledge about the heart diseases and their understanding of the problems presented by these diseases to individuals and communities. This advanced knowledge and understanding have been particularly helpful to paramedical personnel.

REFERENCE

(1) Mosley, K. T.: Oklahoma's heart disease course for multidisciplines. Pub. Health Rep. 73: 355–358, April 1958.

Milk Sanitation Honor Roll for 1959–60

Ninety-five communities have been added to the Public Health Service milk sanitation "honor roll," and 75 communities on the previous list have been dropped. This revision covers the period from January 1, 1959, to December 31, 1960, and includes a total of 273 cities and 118 counties.

Communities on the honor roll have complied substantially with the various items of sanitation contained in the milk ordinance recommended by the U.S. Public Health Service. The State milk sanitation authorities concerned report this compliance to the Service. The rating of 90 percent or more, which is necessary for inclusion on the list, is computed from the weighted average of the percentages of compliance. Separate lists are compiled for communities in which all market milk sold is pasteurized, and for those in which both raw milk and pasteurized milk are sold.

The recommended milk ordinance, on which the milk sanitation ratings are based, is now in effect through voluntary adoption in 496 counties and 1,429 municipalities. The ordinance also serves as the basis for the regulations of 36 States. In 16 States it is in effect statewide.

The ratings do not represent a complete measure of safety, but they do indicate how closely a community's milk supply conforms with the standards for grade A milk as stated in the recommended ordinance. High-grade pasteurized milk is safer than high-grade raw milk because of the added protection of pasteurization. The second list, therefore, shows the percentage of pasteurized milk sold in a community which also permits the sale of raw milk.

Although semiannual publication of the list is intended to encourage communities operating under the recommended ordinance to attain and maintain a high level of enforcement of its provisions, no comparison is intended with communities operating under other milk ordinances. Some communities might be deserving of inclusion, but they cannot be listed because no arrangements have been made for determination of their ratings by the State milk sanitation authority concerned. In other cases, the ratings which were submitted have lapsed because they are more than 2 years old. Still other communities, some of which may have high-grade milk supplies, have indicated no desire for rating or inclusion on this list.

This compilation is from the Milk and Food Program, Division of Engineering Services, Public Health Service. The previous listing, with a summary of rules under which a community is included, was published in Public Health Reports, October 1960, pp. 973–976. The rating method is described in PHS Publication No. 678 (Methods of Making Sanitation Ratings of Milksheds).

Communities awarded milk sanitation ratings of 90 percent or more, 1959–60

100 PERCENT OF MARKET MILK PASTEURIZED

Community	*Date of rating*
Arkansas	
Fort Smith	8– 7–1959
Colorado	
Colorado Springs	10–1960
Boulder County	5–1960
Denver and Denver County	5–1959
Las Animas-Huerfano Counties	1–1960
Pueblo County	8–13–1959
Weld County	7–23–1959
District of Columbia	
Washington	12–11–1959
Georgia	
Albany	8– 5–1960
Athens-Clarke County	8–11–1960
Atlanta-Fulton County	11– 1–1960
Augusta	5–23–1959
Brunswick	11– 9–1959
Cairo	3–22–1960
Calhoun-Gordon County	7–27–1960
Chatham County	9–23–1960
Columbus	10–14–1960
Dalton	2– 5–1960
Fitzgerald	5–27–1959
Moultrie	12–10–1959
Quitman	3–16–1960
Georgia—Continued	
Rome-Floyd County	8– 6–1959
Thomasville	3–18–1960
Troup County	10–13–1960
Valdosta	12– 9–1959
Waycross	3–11–1960
Illinois	
Chicago	5– 4–1959
Joliet	3–27–1959
North Shore municipalities (Glencoe, Kenilworth, Lake Bluff, Lake Forest, Northfield,	

Communities awarded milk sanitation ratings of 90 percent or more, 1959–60—Continued

100 PERCENT OF MARKET MILK PASTEURIZED—Continued

Community	Date of rating
Illinois—Continued	
Wilmette, Winnetka)	6–21–1960
Indiana	
Evansville	5–26–1960
Frankfort	2–10–1959
Huntington	1–14–1959
Kokomo	2–10–1959
Iowa	
Ames	3–15–1960
Anamosa	12– 9–1959
Atlantic	10– 7–1959
Boone	3– 4–1960
Burlington	3–17–1960
Cedar Falls	11–25–1959
Cedar Rapids	8–18–1960
Clarion	10–22–1959
Clinton	8–27–1959
Corydon	2– 2–1960
Davenport	5–12–1960
Des Moines	6– 3–1960
Dubuque	4– 7–1960
Dyersville	12– 8–1959
Eagle Grove	10–19–1959
Estherville	6–10–1960
Fort Dodge	7–29–1959
Grinnell	7– 1–1959
Humboldt	10–20–1959
Ida Grove	4–22–1960
Iowa City	8–25–1960
Lake View	4–20–1960
Le Mars	1–28–1960
Lytton	10–21–1959
Manning	4–20–1960
Maquoketa	12– 9–1959
Marshalltown	10–21–1959
Mason City	1–20–1960
Mount Pleasant	5–16–1960
Ottumwa	10– 7–1960
Paullina	7–20–1960
Pocahontas	10–20–1959
Rockwell City	10–21–1959
Sioux City	4–29–1960
Spencer	2–26–1960
Storm Lake	10–14–1959
Washington	7– 1–1960
Waterloo	11–20–1959
Webster City	10–19–1959
Kentucky	
Ashland and Boyd County	7–23–1959
Bell County	8– 4–1959
Benton	3– 2–1960
Kentucky—Continued	
Bowling Green and Warren County	5–14–1959
Campbellsville	2–13–1959
Covington	7– 8–1960
Cynthiana and Harrison County	8– 9–1960
Danville and Boyle County	2–11–1960
Elizabethtown and Hardin County	11–23–1959
Flemingsburg and Fleming County	8– 8–1960
Frankfort	10– 8–1959
Fulton and Fulton County	8–12–1959
Glasgow	1–17–1959
Georgetown and Scott County	10– 9–1959
Greenville	3–30–1960
Henderson County	7–10–1959
Hodgenville	9– 6–1960
Hopkinsville and Christian County	4–21–1960
Jessamine County	6–17–1959
Louisville and Jefferson County	12–11–1959
Lyon County	3– 1–1960
Mayfield and Graves County	5– 6–1959
McLean County	3–28–1960
Monticello and Wayne County	4–21–1960
Morehead	2– 3–1959
Morgantown	11–24–1959
Mount Sterling	6–16–1959
Murray and Calloway County	1– 7–1960
Newport and Campbell County	9–18–1959
Owensboro	2– 5–1960
Owenton	8–12–1960
Owingsville	6–16–1959
Paducah and McCracken County	5– 1–1959
Paris and Bourbon County	6–15–1959
Pendleton County	8–10–1960
Princeton	7–20–1960
Russellville	2– 2–1960
Shelbyville and Shelby County	6–15–1960
Smithland and Livingston County	3– 1–1960
Kentucky—Continued	
Taylorsville and Spencer County	6–16–1960
Webster County	6–20–1960
Mississippi	
Amory	5– 7–1959
Biloxi	10– 8–1959
Booneville	10–12–1960
Brookhaven	1–26–1960
Canton	6– 9–1960
Cleveland	7–14–1960
Columbia	5–25–1960
Columbus	5– 4–1960
Corinth	4– 9–1959
Eupora	9–24–1959
Greenville	7–25–1960
Greenwood	2– 2–1960
Grenada	9–17–1959
Gulfport	10– 8–1959
Hattiesburg	2–23–1960
Houston	4–15–1959
Iuka	10–13–1960
Jackson	3–26–1959
Kosciusko	4–25–1960
Laurel	3–17–1960
Lucedale	8–17–1960
Meadville	8–23–1960
Meridian	11–18–1959
Morton	4– 7–1960
New Albany	8–27–1959
Oxford	7– 2–1959
Pascagoula	8–18–1960
Picayune	6–11–1959
Starkville	2–10–1959
State College	2–11–1959
Tupelo	9–20–1960
Vicksburg	1–27–1959
West Point	5–18–1960
Missouri	
Cape Girardeau	8–16–1960
Chillicothe	8–19–1959
Hannibal	8–17–1959
Kansas City	10–27–1959
St. Joseph	1–27–1960
St. Louis	6–29–1959
St. Louis County	7–19–1960
Sikeston	12–10–1959
Springfield	3–21–1960
Nevada	
Clark, Nye, and Lincoln Counties	5–18–1959

Communities awarded milk sanitation ratings of 90 percent or more, 1959–60—Continued

100 PERCENT OF MARKET MILK PASTEURIZED—Continued

Community	Date of rating
New Mexico	
Albuquerque	7–21–1960
Artesia	11– 1–1960
Carlsbad	11– 2–1960
Clovis	8– 4–1960
Farmington	7– 8–1960
Portales	10–29–1960
North Carolina	
Alamance County	9–16–1960
Alexander County	1– 9–1959
Alleghany County	6–28–1960
Anson County	8–31–1960
Ashe County	6–28–1960
Beaufort County	5–14–1959
Bertie County	6– 9–1960
Burke County	9–27–1960
Camden County	6– 9–1960
Catawba County	1– 9–1959
Chowan County	6– 9–1960
Cleveland County	9–12–1960
Craven County	7–24–1959
Cumberland County	11–27–1959
Currituck County	6– 8–1960
Dare County	6– 8–1960
Durham County	12–18 1959
Edgecombe County	9–10–1959
Forsyth County	6–24–1960
Gates County	7–21–1960
Granville County	8–10–1960
Guilford County	11–20–1959
Halifax County	6–22–1959
Harnett County	8–11–1960
Haywood County	3–30–1960
Henderson County	8–30–1960
Hertford County	7–21–1960
Iredell County	12–11–1959
Jackson County	3–19–1959
Lenoir County	4– 7–1959
Lincoln County	1– 9–1959
Macon County	3–19–1959
Madison County	6–15–1960
Martin County	7– 7–1960
Mecklenburg County	10–23–1959
Montgomery County	4– 7–1960
Moore County	7–13–1960
Nash County	10–14–1959
New Hanover County	12–10–1959
Northampton County	8–16–1960
Onslow County	5–13–1959
Pamlico County	8–28–1959
Pasquotank County	6– 9–1960
Pender County	3– 2–1959
North Carolina—Continued	
Perquimans County	6– 9–1960
Pitt County	7– 7–1960
Randolph County	5–11–1960
Richmond County	5–12–1960
Rockingham County	5– 3–1960
Rocky Mount	10–14 1959
Sampson County	11– 1–1960
Scotland County	6–23–1960
Stokes County	5–24–1960
Swain County	3–19–1959
Tyrrell County	2–18–1960
Union County	8– 3–1960
Warren County	10–13–1960
Washington County	2–18–1960
Watauga County	6–28–1960
Wayne County	11– 5–1959
Wilkes County	5–25–1960
Wilson County	8–28–1959
Oklahoma	
Mangum	11–12–1959
Oklahoma City	10–28–1960
Okmulgee	10– 4–1960
Ponca City	9–30–1960
Tulsa	6–15–1959
Tennessee	
Athens	9– 3–1959
Cleveland	9– 2–1959
Columbia	9–28–1960
Cookeville	6–30–1960
Fayetteville	6–30–1960
Greeneville	4–27–1960
Jackson-Madison County	9– 1–1690
Kingsport	1–20–1960
Kingston	8–16–1960
Knoxville	5– 6–1959
Lewisburg	10–25–1960
Livingston	1– 7–1959
Loudon	5–23–1960
Manchester	10–12–1960
Maryville and Alcoa	3–29–1960
Memphis	8–18–1959
Morristown	5–25–1960
Mount Pleasant	9–26–1960
Murfreesboro	7–21–1959
Nashville-Davidson County	10–21–1959
Pulaski	8– 3–1959
Rogersville	4–26–1960
Sparta	7–14–1960
Tullahoma	10–10–1960
Texas	
Amarillo	5– 3–1960
Big Spring	8–21–1959
Brownfield	6– 9–1959
Brownwood	6–29–1959
Bryan	7–17–1959
Burkburnett	8–11–1959
College Station	7–16–1959
Corpus Christi	5–11–1959
Denver City	6– 8–1959
Edinburg	1–25–1960
El Paso	9–11–1959
Falfurrias	9–10–1959
Fort Worth	5–28–1959
Gonzales	7–24–1959
Harlingen	9–10–1959
Kingsville	5– 6–1959
Levelland	6–11–1959
Lubbock	9– 2–1960
McAllen	1–26–1960
Mercedes	1–26–1960
Midland	8–21–1959
Mineral Wells	7–10–1959
Odessa	8–21–1959
Paris	3–11–1960
San Angelo	9– 4–1959
San Antonio	3– 6–1959
San Benito	9 10–1959
Seagraves	6– 8–1959
Seminole	6– 8–1959
Sweetwater	9–25–1959
Texarkana	6–24–1959
Victoria	1–19–1959
Wichita Falls	10–21–1960
Utah	
Logan	6–10–1960
Ogden	2–25–1960
Salt Lake City	5–26–1960
Utah County	3–23–1960
Virginia	
Alexandria	6–10–1959
Blacksburg	9–22–1960
Christiansburg	9–22–1960
Lynchburg	4–14–1959
Marion	4–22–1959
Norfolk	6– 3–1960
Petersburg	11– 7–1960
Portsmouth	3–27–1959
Radford	9–22–1960
Richmond	4–25–1960
Roanoke	7– 8–1960
South Boston	5–13–1959
Staunton	3– 8–1960

Communities awarded milk sanitation ratings of 90 percent or more, 1959–60—Continued

100 PERCENT OF MARKET MILK PASTEURIZED—Continued

Community	Date of rating
Virginia—Continued	
Waynesboro	4–21–1960
Washington	
Everett	10–28–1959
Spokane	9–27–1960
Tacoma	8–25–1959
Whitman County	10–27–1960
West Virginia	
McDowell County	8– 1–1960
Ohio County	11–14–1959
Wisconsin	
Appleton	1–13–1959
Beaver Dam	2–13–1959
Wisconsin—Continued	
Eau Claire County (Eau Claire, Altoona, Augusta, and Fairchild)	2– 3–1959
Kaukauna	1– 6–1959
Ripon	2–13–1959
Stevens Point	2–19–1959
Waupun	2–13–1959

BOTH RAW AND PASTEURIZED MARKET MILK

Community and percent of milk pasteurized	Date of rating
Arkansas	
Little Rock, 99.8	10–14–1959
Georgia	
Carrollton, 99.8	2–12–1959
Macon, 99.85	11– 9–1959
Newnan, 99	11–20–1959
Washington, 99.87	2–25–1959
Iowa	
Carroll, 98.5	5–14–1960
Kentucky	
Lexington and Fayette County, 99.7	5–12–1960
Madisonville and Hopkins County, 99.8	7–21–1960
Somerset and Pulaski County, 96	6–10–1960
North Carolina	
Buncombe County, 99.1	9–20–1959
Caldwell County, 97.7	6– 7–1960
Robeson County, 98.2	2–24–1960
Oklahoma	
Lawton, 99.5	1–15–1959
Shawnee, 98.98	1–29–1960
Stillwater, 99.7	5–26–1960
Oregon	
Portland, 99.9	9–18–1959
Tennessee	
Harriman, 95	8–16–1960
Texas	
Abilene, 99.67	7– 2–1959
Austin, 99.9	11–19–1959
Texas—Continued	
Brownsville, 99.3	8–27–1959
Denton, 97.7	7–30–1959
Hereford, 97	3–27–1959
Laredo, 96.6	6– 9–1959
Marshall, 98.8	4–23–1959
Palestine, 99.79	7–10–1959
Waco, 99.97	9–25–1959
Virginia	
Charlottesville, 99.7	10–15–1959
Danville, 99.6	10–28–1960
Washington	
Seattle-King County, 99.7	5–12–1959
West Virginia	
Monongalia County, 98.4	7–15–1960

NOTE: In these communities the pasteurized market milk shows a 90 percent or more compliance with the grade A pasteurized milk requirements, and the raw market milk shows a 90 percent or more compliance with the grade A raw milk requirements, of the milk ordinance recommended by the United States Public Health Service.

Notice particularly the percentage of the milk pasteurized in the various communities listed. This percentage is an important factor to consider in estimating the safety of a city's milk supply. All milk should be pasteurized, whether commercially or at home, before it is consumed.

Federal Publications

Children Who Receive Services From Public Child Welfare Agencies. *Children's Bureau Publication No. 387; 1960; by Helen R. Jeter; 60 pages; 25 cents.*

A study of some 220,000 children in 45 States in 1959 provides the most complete description of children receiving public welfare services since 1945. Text, tables, and charts present data on age, sex, color, marital status of parents, and living arrangements.

Findings in 1959 are compared with those in 1945 and suggestions are made for further study.

Health Leaflets for Spanish-Speaking Migrant Families. *PHS Publication No. 795; 1960; by William Yanniello and Helen Johnston; 12 pages.*

Health education leaflets dealing with accident prevention, maternal and child health, nutrition, sanitation, tuberculosis, and venereal disease are listed by subject. Except for a few in Spanish only, the leaflets are available in both English and Spanish. Some are intended especially for use with Puerto Ricans.

Enzymology in the USSR. A review of the literature. *PHS Publication No. 782; 1960; by Chester W. De Long; 189 pages; 65 cents. (Separate: Supplement with additional bibliography, 38 pages.)*

This review of Soviet research on human and animal enzymes, microbial enzymes, and plant enzymes offers capsule summaries of major directions taken to date by Russian enzymological research. Although little information is offered that is new, the bibliography is extensive and up to date.

Prototype Hospital. Fallout protected. *PHS Publication No. 791; 1960; 25 pages.*

Recognized protection measures against radioactive fallout are applied to construction of a 150-bed hospital designed to serve an average American community. Details are given for shelter space, sleeping facilities, shielding, food service, electric power, ventilation and air conditioning, water supply, plumbing, heating, sanitation, housekeeping functions, department relations, and communications.

Design data and cost estimates for incorporating fallout protective measures in new hospitals and for additions to existing hospitals are presented.

The Study of Influenza. A translation from the Russian. *PHS Publication No. 792; 1960; by V. M. Zhdanov, V. D. Solov'ev, and F. G. Epshtein (with contributions by A. S. Gorbunova, L. L. Fadeyeva, and L. Ya. Zakstel'skaya); 939 pages.*

This monograph summarizes results of studies of influenza carried on in the last 10 to 12 years, by three groups of Russian investigators under the direction of the authors at the Ivanovsky Institute of Virology; the Academy of Medical Sciences, USSR, Moscow; the Mechnikov Institute of Vaccines and Sera, Khra'kov; and the Mechnikov Institute of Vaccines and Sera, Moscow. An extensive bibliography, totaling more than 2,000 citations for the entire monograph, accompanies each of the 10 chapters.

Aseptic Nursing Techniques. A survey of maternity departments in thirteen medical centers. *PHS Publication No. 788; 1960; by Margaret W. Thomas; 145 pages; $1.*

Results of a survey of nursing practices as they relate to prevention and control of infection in the nursery, a study of standards and procedures recommended by selected authorities, and an interpretation of the recommendations in relation to principles of nursing care are presented. Suggestions are offered for certain areas for which no recommendations were available in the source documents.

Subjects covered include physical facilities, space allocation, environmental conditions, equipment, patient care, formula preparation, personnel, care of linen, housekeeping, care of equipment following discharge, development of procedures, and infections surveillance and control.

A worksheet for recording aseptic practices, a list of source documents for standards, and a reference chart of recommended practices are included in the appendixes.

Clean Water. A challenge to the Nation. *PHS Publication No. 816; 1961; 48 pages; 35 cents.*

Highlights and recommendations of the National Conference on Water Pollution are presented. Excerpts of major addresses are included together with reports of panel discussions.

Refuse Collection and Disposal. An annotated bibliography, 1958–1959. *PHS Publication No. 91 (Public Health Bibliography Series No. 4, Supplement D); by Edward R. Williams; 48 pages.*

References in this supplement, the latest in the bibliography series covering administrative and operational phases of refuse collection and disposal, are arranged under 13 subheadings relating to the overall subject. Annotations are provided.

This section carries announcements of new publications prepared by the Public Health Service and of selected publications prepared with Federal support.

Unless otherwise indicated, publications for which prices are quoted are for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. Orders should be accompanied by cash, check, or money order and should fully identify the publication. Public Health Service publications which do not carry price quotations, as well as single sample copies of those for which prices are shown, can be obtained without charge from the Public Inquiries Branch, Office of Information, Public Health Service, Washington 25, D.C.

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